# A SYSTEM

OF

# PRACTICAL ARITHMETIC,

ADAPTED TO

***BRITISH INDIA***

PUBLISHED BY PERMISSION OF

*HIS EXCELLENCY THE MOST NOBLE*

RICHARD MARQUIS WELLESLEY, K. P.

*Governor and Captain General, &c. &c. &c.*

BY

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## APPENDIX.


FORMS OF ACCOUNTS CURRENT, INTEREST ACCOUNTS, INVOICES, ACCOUNTS SALE, AND BILLS OF EXCHANGE.

# INTRODUCTION.

COMMERCE, is the exchange of commodities; or the buying, selling, or trafficking of merchandize, money, or even paper, in order to profit by the fame.

There is no doubt but commerce is nearly as ancient as the world itfelf; neceffity fet it on foot; the defire of conveniency improved it; and variety, luxury, and avarice, have brought it, to its prefent ftate.

A MERCHANT, is one who buys, or trades, in any thing; and as merchandize includes all goods, and wares, expofed to fale; fo the word MERCHANT formerly extended to all forts of traders, buyers, and fellers. But every one that buys, and fells, is not at this day under the denomination of MERCHANT; only thofe who traffic in the way of commerce by importation, or exportation, or carry on bufinefs by way of barter or exchange, and who make it their living to buy and fell by a continual affiduity or frequent negociation, in the myftery of merchandizing, are efteemed MERCHANTS.

The MERCANTILE profeffion is efteemed noble and independent; and no where more valued than in England, where the younger fons, and brothers of the beft families are frequently bred up to merchandize.

The principal qualifications for a MERCHANT, are:

1ft.—To write properly and correctly.

2d.—To underftand all the rules of arithmetic, which have any affinity or relation to commerce.

To keep books of fingle and double entry, as Journals, Ledgers, &c.

3d.—To know the agreement between the monies, weights, and meafures of different parts.

5th.

5th.—The rates of exchange, according to the course of different places.

6th.—The customs, or duties, due on importation and exportation of merchandize, according to the usage of the places that he trades to.

7th.—That he ought on all occasions to have a strict regard to truth, and avoid fraud and deceit, as corroding cankers to his reputation, and fortune; for, however cunningly the mask is wore, chance may, but time certainly will discover the cheat, and render the wearer exposed to the contempts and insults of those he has imposed on. That he should act with great caution and circumspection; as first, to make himself master of that branch of commerce he intends to engage in; and if he does not transact this business personally, to be cautious in his choice of factors, or agents, above all, that they be noted for their capacity and integrity, otherwise, instead of an expected advantage, through the treachery, neglect or ignorance of his agent, the best laid scheme may produce considerable loss: for which reason he should not be drawn in to employ an agent, whose character he is unacquainted, even from that most prevailing one, of serving for a less commission, as no trade is worth carrying on, that will not afford the allowance generally made.

In buying of merchandize, it is necessary to be extremely circumspect in his words, that his desire of having the goods he is treating for, may not appear, and should not slight or undervalue them, in order to be thought not to want them, as this cunning only serves to embarrass the mind, and make him (the seller) more firm and tenacious under the uncertainty: on the contrary, he ought to act with sincerity and frankness, accompanied, however, with prudence, and to avoid tricks and subtlety.

In conducting his sales, a merchant should avoid many words and

circumlocutions,

circumlocutions, as this looks more like a retailer, than one who is not ſo; and ſuppoſing he is treating with one of this laſt diſtinction, he may be aſſured, the buyer underſtands the value of the goods, ſo that the merchant only occaſions himſelf an unneceſſary trouble to aſk much out of the way; therefore, what is principally to be obſerved in ſales on truſt is, that his debtor be one noted for his punctuality and honeſty, and alſo diſpatching large quantities of goods, which ſhould induce a preference (though with leſs profit), than to another of inferior credit, and a ſhorter trade.

If it happens, that debtors omit paying what they owe at the time agreed upon, the creditors ſhould not oppreſs them with an extravagant intereſt, for though neceſſity obliges them ſeemingly to ſubmit, it is a ſure canker to their fortunes, which too often at laſt involves the truſted, and him that truſts, in ruin. Beſides, if the latter eſcape a failure, he has drawn the other into, I ſhould think he could not the laſhes of conſcience, when he reflects on his occaſioning the debtor's misfortunes, by the extortion he had impoſed.

He ought never to lend to any ſort of perſon, whatſoever on an unjuſtifiable ſecurity nor to take an unwarrantable intereſt; for this is a deteſtable act, and expoſes the Usurer to the penalty of the law, and renders him abominable, both in the ſight of God, and man.

A Merchant ſhould never ſell any of his goods in ſmall parcels, except drove thereto by mere neceſſity, as this is derogating from his character, and will occaſion him the loſs of his retail cuſtomers.

There is not, in the whole circle of ſociety, a claſs of men more eminently uſeful than that of the merchants. Their active induſtry ſupplies ſubſiſtence and proviſions for a whole country, and their efforts animate the induſtry of the manufacturer and the artiſt. In general, we may obſerve, they become rich with the increaſing wealth and comfort of the community;

community; their credit rest upon a reputation of probity and fair dealing, and their profits are in proportion to the risques which they may encounter. They cannot augment their fortunes without exposing them, and augmenting at the same time the fortunes of the public; and their profession and their talents are in estimation wherever any portion of good sense is to be found. They have been uniformly encouraged in every country where there ever has existed any shadow of a reasonable and legitimate government; and they are naturally the friends and supporters of liberty and law, because without liberty and law, no commerce can be expected to flourish, or even to exist. Within the period of the last century, they had been gradually rising into importance and general estimation, and philosophy had numbered them among the most steady benefactors of the human race.

A FACTOR or AGENT, is a person who acts for a merchant by commission, either in the buying, or in the selling, of goods, or in both; they should strictly observe the orders of their principals, or else, they are liable to the damage accruing from the neglect of them. AGENT is more properly, for the receiving and paying of monies.

BROKERS are of three kinds, EXCHANGE-BROKERS, STOCK-BROKERS and PAWN-BROKERS.

EXCHANGE-BROKERS, are a sort of negociators, who contrive, make and conclude bargains, between merchants and tradesmen, in matters of money or merchandize, for which they have a fee, or premium called BROKERAGE. At several places, the manner of negociating has something in it very particular; after the brokers have launched out into long, and usually impertinent discourses, coming towards a conclusion, they only converse with their fingers. The buyer's, and seller's broker, each take the other by the right hand, which they cover with a cloth, or otherwise; the finger stretched out stands for six; bent for five; the

tip

tip of the finger for one; the whole hand 100; and the hand clenched for 1000. They will expreſs even fractional parts, as annas, and pauys, by their hands. During all this myſtic commerce, the two brokers appear as cold and compoſed, as if there were nothing paſſing between them.

STOCK-BROKERS are thoſe employed to buy and ſell ſhares in the joint ſtock of a company or corporation.

PAWN-BROKERS are perſons who keep ſhops, and lend money to neceſſitous people, upon pledges for the moſt part on uſurious conditions.

BANK, in commerce, is a denomination given to certain ſocieties, or communities, who take on them the charge of the money of private perſons, to keep it ſecure, and may be properly defined, a common repoſitory, where many perſons agree to keep their caſh, to be always ready at their call or direction. The buſineſs of the bank is for the moſt part, diſcounting bills, advancing money on ſecurities, circulating their own notes, &c. &c.

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## OF FAILURES OR BANKRUPTCIES,

*How to be guarded againſt.*

Could Trade be always carried on with that credit which is neceſſary to ſupport it and with that ſucceſs which every one hopes for, by adventuring in it—it would be the moſt pleaſant, as well as the moſt beneficial employ that any one could undertake; but, as we are all ſubject to the uncertain fluctuating ſtate of humanity, our ſerenity will be ſometimes intercepted and our calms and ſun ſhine be obſcured and ruffled by the clouds and tempeſts of adverſity, as well in this as in all other employs, of life, and the ſmooth paths of buſineſs will often become rugged and ſtrewed with thorny troubles, to the utter change of the pleaſing ſcene, by introducing inevitable loſſes and misfortunes, inſtead of the advantages,

tages we flattered ourſelves with the hopes of reaping from our commercial engagements. Thus, the beſt laid ſcheme may be overſet by ſome intervening occurrence, and a trifling accident frequently demonſtrates the weakneſs of our judgment, and the ſhallowneſs of our deſigns; though, whilſt we ſubmit our actions to the directions of prudence, and ſuffer our ſteps to be guided by her, we may juſtly be ſaid to act like reaſonable men; and, however providence (for our puniſhment) may diſpoſe otherwiſe, we certainly take the beſt and likelieſt methods of ſecuring to ourſelves, that ſucceſs and proſperity which we are ſoliciting; and in order to guard againſt their reverſe, permit me to ſhew the cauſes which naturally drive men to ſplit on that rock, where ſo many thouſands have been wrecked.

The failures of merchants oftener proceed from ignorance, imprudence, and ambition, than from malice and deſign; and I will endeavour to guide them from running on the aforementioned ſhoals, by perſuading them to aim at the diſſipation of the fogs of ignorance by the ſun ſhine of learning, to correct imprudence, and to baniſh vain-glory or ambition. The firſt may be done by a ſtrict attention to buſineſs, whilſt under the tuition of a merchant in an apprenticeſhip; or if this has been neglected, and my reader comes into trade, without ſuch uſual form and inſtruction, REASON if engaged and uſed, will be too hard for imprudence; and ambition, I ſhould think would be checked by diſplaying the fatal conſequences of it; and by theſe means, a failure proceeding from all, or any of the abovementioned cauſes, may be prevented; though ſtill there remains one, from which no foreſight or care can defend us: I mean the immediate diſpoſitions of providence, to which we ought chearfully to ſubmit, with a perfect reſignation, and never murmur nor repine at any of his diſpenſations, under a full aſſurance that he will

afford

afford ſupport and comfort under the affliction, to every one who ſincerely truſts in him; and, when he ſees convenient, give a happy releaſe from it. It is true, theſe are hard leſſons to mankind, and rendered more irkſome by the barbarous treatment the unhappy too commonly meet with; for though it is natural to imagine that a man who has been truly honeſt in all his dealings, and ſeemingly been eſteemed for his integrity, ſhould on a reverſe of fortune, meet with that pity and kind uſage he has ſhewn to others under ſimilar diſtreſſes; but experience convinces us, that this is rarely the caſe; on the contrary it is generally found, that though friends may ſeem many, and ſtaunch in the time of proſperity, yet on a change of circumſtances, they will drop off like blaſted fruit, quite forgetful of favors ſhewn to, and kindneſſes done them; and at the time you become a bankrupt in your fortune, you will certainly find them ſo, in affections and returns of gratitude. Favors ſeem no longer regarded than you are in a capacity to continue them, and obligations are thruſt among the number of nonentities, or at leaſt are become ſuch unfaſhionable things, as only to be owned by the very few conſcientious and benevolent.

Actions of benevolence are not to be expected from creditors, whoſe loſſes generally ſour their tempers, and keep their reſentments warm againſt the unhappy occaſion of them, even to the extinction ſometimes of humanity. But one ſhould think that the lamentation of a fallen familiar and intimate (frequently heightened by the tears of a tender wife, and affecting cries of their innocent babes) would be prevailing objects to excite compaſſion from thoſe who have always experienced a courteous and gentle treatment from the unhappy ſufferers; but philanthropy is almoſt loſt among us, and mankind are grown ſo degenerate, as to become inſenſible to the diſtreſſes of others, much leſs to defend them from, and adminiſter relief under them; the unfortunate man is now equally ſhunned with the infected one, and the beſt uſage he finds is ſlights from every in-

dividual

dividual of his quondam acquaintance, whilst the worst is swelled to an immoderate height, by insults offered him, contumelies and reproaches thrown out against him, and abuses, invectives, and unmerited aspersions, are frequently added to complete the catalogue, and augment his miseries. Few regard him, fewer still caress him, and the paucity of those who protect or assist him, are reduced to the lowest degree of comparison. This is generally the case with those whom fortune has prostrated and laid low; though there is still a small remnant of men among us, who actuated by every tender sentiment of humanity, and as opportunities offer, exercise every social virtue; whose compassion is extended to all afflicted objects, and their charity stretched to the utmost limits that prudence and discretion can warrant; they remain uninfluenced by the example of their neighbours, and continue fixed and immoveable in the principles of goodness and benevolence: but these guardian angels are scarce, and even when found, can (at best) only alleviate, and in some degree mitigate and take off the sharp edge of affliction, though they cannot restore lost credit and reputation; this only can be done by the man himself, and the sole means is the making every satisfaction to his creditors, that his abilities will permit. This lesson, honesty and a just reflection on things will teach you; and as the miseries subsequent to and attendant on a failure are extensive, as have been (though but faintly) represented, it is natural to suppose, the bare description, will render every other persuasive superfluous—for avoiding the causes of such great unhappiness.

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| Strettle Edward | 1 |
| Subchund Dutt | 1 |
| Stewart and Morriſon | 1 |
| Shobrook W. | 1 |
| Shawe Major M. | 1 |
| Seton J. | 1 |
| Speake Samuel | 1 |
| Stalkart Mrs. M. | 2 |

## T.

| | Copies. |
|---|---|
| Thackeray R. | 1 |
| Torckler Peter | 1 |
| Torry James | 1 |
| Taylor James | 1 |
| Taylor John | 1 |
| Tulloh and Co. | 1 |
| Thomſon Archibald | 1 |
| Taylor Joſeph | 1 |
| Turner Richard | 1 |
| Turner John | 1 |
| Thornhill John | 1 |
| Todd J. O. | 1 |
| Tucker Henry St. George | 1 |
| Taylor Capt. James | 1 |
| Torckler Edward | 1 |
| Templeton Thomas | 1 |
| Turner Benjamin | 1 |
| Thompſon and Green | 1 |

## U.

| | |
|---|---|
| Umcy George | 1 |

## V

| | |
|---|---|
| Vialars E. | 1 |

## W

| | |
|---|---|
| Welleſley Moſt Noble Richard Marquis | 4 |
| Walters William Greene | 1 |
| Wallerlow John | 1 |
| Wadlern W. | 1 |
| Watſon Peter | 1 |
| Walker Lt. W. B. | 1 |
| Watſon Col. S. | 1 |
| Wauchope J. | 1 |
| White Capt. H. V. | 1 |
| Williams Robert | 1 |
| Walpole R. | 1 |
| Williams H. A. | 1 |
| Wyatt G. N. | 1 |
| Winter F. | 1 |
| Wilford Capt. F. | 1 |

# ARITHMETIC,

## *IN WHOLE AND COMPOUND NUMBERS.*

ARITHMETIC is the art of numbering and teaches how to compute, truly, and with expedition and eaſe. It conſiſts chiefly in five great or fundamental rules, for the operations, viz.

## NUMERATION OR NOTATION, ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION.

An integer or whole number, is an unit or 1, or any number of units; as 7, 48, 105, 1785, &c.

A compound number, conſiſts of different denominations; as rupees, annas, and paaee; or mons, ſars, and chuttaaks; thus, 4 rupees, 6 annas, 5 paaee; or 13 mons, 6 ſars, 4 chuttaaks, &c.

Numeration.

## NUMERATION.

IS the reading or writing in words any number given in figures; alfo, the writing in figures any number expreffed in words, according to its true value.

The figures by which numbers are expreffed, are the nine following, viz. 1, 2, 3, 4, 5, 6, 7, 8, 9; with thefe there is ufed the mark or character 0, called a cipher, which of itfelf ftands for nothing, but being annexed to the right hand of a figure, alters its value; thus, 40, fignifies forty; 400, fignifies four hundred, &c.

## TABLES.

| Tens of Krores. | Krores. | Tens of Lacs. | Lacs. | Tens of Thoufands. | Thoufands. | Hundreds. | Tens. | Units. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 5 |
| | | | | | | | 4 | 4 |
| | | | | | | 7 | 5 | 6 |
| | | | | | 9, | 8 | 7 | 3 |
| | | | | 5 | 0, | 2 | 1 | 6 |
| | | | 4, | 2 | 3, | 3 | 0 | 1 |
| | | 5 | 6, | 2 | 1, | 7 | 6 | 0 |
| | 3, | 2 | 1, | 7 | 8, | 2 | 3 | 7 |
| 5 | 4, | 3 | 2, | 1 | 2, | 3 | 4 | 5 |

| | | |
|---|---|---|
| 100 Thoufands, | make one | Lac |
| 100 Lacs | . . . . . | Krore |
| 100 Krores | . . . . | Puddum |
| 100 Puddums | . . . | Khurrub |
| 100 Khurrubs | . . . | Sunkun |

| Hundreds of Millions. | Tens of Millions. | Millions. | Hundreds of Thoufands. | Tens of Thoufands. | Thoufands. | Hundreds. | Tens. | Units. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 6 |
| | | | | | | | 5 | 4 |
| | | | | | | 7 | [illegible] | 2 |
| | | | | | 4, | 5 | 6 | 7 |
| | | | | 5 | 6, | 7 | 8 | 9 |
| | | | 6 | 7 | 8, | 9 | 0 | 1 |
| | | 7, | 8 | 9 | 0, | 1 | 2 | 3 |
| | 8 | 9, | 0 | 1 | 2, | 3 | 4 | 5 |
| 9 | 8 | 7, | 6 | 5 | 4, | 3 | 2 | 1 |

### *EXAMPLES.*

Write down 350 . 4567 . 75302 . 207600 . 5003200 . 76549005 . 753627180 . in words at length.

Exprefs in figures, five thoufand and feventy-four.

Exprefs in figures, nine hundred and eighty-feven millions.

Exprefs in figures, five lacs.

Exprefs in figures, three lacs, forty-four thoufand, five hundred and ten.

Exprefs in figures, ninety-eight krores, five lacs, and ninety thoufand.

The

The Bengalese have a method of reckoning by the joints of their fingers, beginning with the lower joint of the little finger and proceeding to the thumb, the ball of which is also included as a joint, and thus the whole hand contains fifteen.

From this method of performing numeration on the joints, arises the well known custom among the Indian merchants of settling all matters of purchase and sale, by joining their hands beneath a cloth, and then touching the different joints, as they would increase or diminish their demands.

## ADDITION OF INTEGERS.

IS to add two or more numbers of like kind together, into one sum called the TOTAL.

*RULE.*

1.—Place all the numbers of a like kind under one another, that is, units under units, tens under tens, hundreds under hundreds, &c.

2.—Begin at the units place and reckon up all the figures in that column from the bottom to the top, and what overplus there is above even tens, set down, and carry one for every ten to the next column, and so on, continuing to the last or left hand column, at which set down the Total.

*PROOF.*

Begin at the top and reckon the figures downwards, in the same manner as you added them upwards; and if the sum comes the same as before, you may conclude it is right.

*EXAMPLES.*

| | | | | |
|---|---|---|---|---|
| | 8765 | 76543 | 2345578 | 98765432 |
| | 327 | 21012 | 987654 | 12938475 |
| | 542 | 3456 | 321 | 64534219 |
| | 29 | 78901 | 4796598 | 28374655 |
| TOTAL | 9663 | 179912 | | |

What is the sum of 126983, 81521, 2118, 312, 604, and 24? Answer 211662.

Add together into one sum 234563, 41234, 312, 2, 4286, 302, 56. Answer 280755.

Add together into one sum 878761, 2180, 815, 42, 124, 4210, 432, 25.

Answer 886590.

SUBTRACTION

## SUBTRACTION OF INTEGERS.

Is the taking of a leſſer number out of a greater of like kind, whereby to find out a third number, which is the difference, and is called the REMAINDER.

*RULE.*

1.—Place the greater number uppermoſt, and the other under it, ſo that units may be under units, tens under tens, &c. and draw a line under them.

2.—Begin at the right hand or place of units, and ſubtract the lower figure from the upper, and ſet down the difference underneath them, do the ſame with the reſt of the figures.

3.—When the under figure exceeds that which ſtands above it, you muſt borrow 10, and add it to the upper number, from which ſubtract the lower, and ſet down the remainder; carry one to be added to the next lower figure, and ſubtract the ſum from the upper, ſetting down the remainder, and ſo on from one row to another.

*PROOF.*

To the leſſer number add the remainder, if the ſum be like the greater, the work is right.

*EXAMPLES.*

| | | | | |
|---|---|---|---|---|
| FROM ... | 94567 | 368149 | 86459 | 869426017 |
| TAKE ... | 72363 | 126154 | 21821 | 214981764 |
| REMAINDER | 22204 | 241995 | | |
| PROOF .. | 94567 | 368149 | | |

From 543210, take 46502. From 76540329, take 500398.
I borrowed 5000, and paid in part 575 Rupees, what ſum remains to be paid.
What is the difference between 5555 and 99.

## MULTIPLICATION OF INTEGERS.

Is the increaſing of any one number by another, ſo often as there are units in that number by which the one is increaſed, and ſerves inſtead of many additions.

In this rule there are two numbers given, called factors; viz. one to be multiplied, called the multiplicand, and another by which it is multiplied, called the multiplier, to find a third or the number produced in multiplying, which is called the product.

PROOF

*PROOF.*

The most correct method is to divide the product by the multiplier, and the quotient, if the work be right, will be the same as the multiplicand, but as the learner is supposed not yet to know the rule of Division, he cannot prove by it; he must therefore make the multiplicand the multiplier, then if the product is the same as the other, the work is right.

There is a way of proving Multiplication, by casting away the nines, and is very expeditious, but liable to error, therefore not to be depended upon, I shall shew both ways in its proper place.

TABLE,

*TO BE [illegible] PERFECTLY BY HEART.*

| 1 | [illegible] | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 | — | 9 | [illegible] | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 | — | — | [illegible] | [illegible] | [illegible] | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 | — | — | — | [illegible] | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 | — | — | — | — | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 | — | — | — | — | — | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 | — | — | — | — | — | — | 64 | 72 | 80 | 88 | 96 |
| 9 | — | — | — | — | — | — | — | 81 | 90 | 99 | 108 |
| 10 | — | — | — | — | — | — | — | — | 100 | 110 | 120 |
| 11 | — | — | — | — | — | — | — | — | — | 121 | 132 |
| 12 | — | — | — | — | — | — | — | — | — | — | 144 |

## *THE USE OF THE TABLE.*

☞ *Find one of the two figures on the left side, and the other at top, then in the angle of meeting is their product sought.*

*Thus, to multiply 5 by 8, seek 8 in the upper line, and under it against 5 on the left hand, is 40, the product; and so of others.*



### *CASE.*

1.—To multiply by a single figure, or when the multiplier is under 13.

### *RULE.*

1.---Place the multiplier underneath the units place of the multiplicand.

2.---Multiply from the right hand to the left; thus, multiply the units figure of the mutiplicand by the multiplier, if the product be less than 10, set it down under its own place of units, but if their product exceeds 10 (or tens), then set down the excess only (as in Addition) and carry 1 for every 10 to the product of the next figure of the multiplicand, setting down the excess above 10 (or tens) as before; do thus untill you come to the last figure, whose product must be set down entire.

### *EXAMPLES.*

| | | | | | |
|---|---|---|---|---|---|
| Multiplicand | 5243 | | 7546 | 9876 | 567839 |
| Multiplier | 2 | | 3 | 4 | 5 |
| Product . | 10486 | | 22638 | | |




| | | | | | |
|---|---|---|---|---|---|
| Multiply . | 7653 | 8953 | 5476 | 9549 | 9876 |
| By . . . | 6 | 7 | 8 | 9 | 12 |
| Product . | | | | | |

To prove the foregoing examples by casting away the nines, make a cross, add all the figures of the multiplicand together, as units, thus, (take the example 1;) 5 and 2 is 7 and 4 is 11 and 3 is 14, throw away the nines, and set the remainder 5 on the side of the cross; do the same with the multiplier (2), but as there are no nines to throw away, I set down 2 on the other side the cross. Do the like in the product; thus, 1 and 4 is 5,

and

and 8 is 13 and 6 is 19, throw away the nines and there remains 1, to be ſet at the top of the croſs. Laſtly, multiply the figures on the ſides, thus, twice or two times 5 is 10, throw away the nines and ſet the remainder 1 at bottom of the croſs, which being the ſame as the top, proves the work to be right.

*CASE.*

2.—When the multiplier conſiſts of ſeveral figures.

*RULE.*

1.—Place each figure in the multiplier reſpectively under its own kind in the multiplicand, that is, units under units, tens under tens, &c.

2.—Multiply the multiplicand by each figure of the multiplier, obſerving to place the firſt figure of each particular product, underneath that figure of the multiplier, which you mutliply with.

3.—Add the particular products together and their ſum, will be the deſired or whole product.

*EXAMPLES.*

| | | | | |
|---|---|---|---|---|
| Multiplicand . . . . | 5432 | 7659 | 9873 | 3547 |
| Multiplier . . . . . | 13 | 15 | 16 | 18 |
| Particular Products . | 16296<br>5432 | | | |
| Product . . . . . . | 70616 | 114885 | 157968 | 63846 |

*PROOF OF THE FOREGOING EXAMPLES.*

| | | | | |
|---|---|---|---|---|
| Multiplicand . . . . | 13 | 15 | 16 | 18 |
| Multiplier . . . . . | 5432 | 7659 | 9873 | 3547 |
| | 26<br>39<br>52<br>65 | | | |
| Product . . . . . . | 70616 | 114885 | 157968 | 63846 |

| | | | | |
|---|---|---|---|---|
| Multiplicand . . . . | 528 | 374 | 798 | 546 |
| Multiplier . . . . . | 374 | 528 | 546 | 798 |
| | 2112<br>3696<br>1584 | | | |
| Product . . . . . . | 197472 | 197472 | 435708 | 435708 |

Multiply

| | | |
|---|---|---|
| Multiply | 31246812 by 16. | Anfwer 499948992. |
| Multiply | 34216812 by 23. | Anfwer 786986676. |
| Multiply | 3841265 by 63. | Anfwer 241999695. |
| Multiply | 21806847 by 84. | Anfwer 1831775148. |
| Multiply | 281642 by 458. | Anfwer 128992036. |
| Multiply | 864927 by 653. | Anfwer 564797331. |
| Multiply | 302614 by 362. | Anfwer 109546268. |
| Multiply | 621452 by 984. | Anfwer 611508768. |

What is the product of 368121456 and 2345. Ans. 863244814320.

| | | |
|---|---|---|
| Multiply | 460136527 by 3615. | Anfwer 1663393545105. |
| Multiply | 746542 by 253648. | Anfwer 189358885216. |
| Multiply | 253648 by 746542. | Anfwer 189358885216. |

*CASE.*

3.—When ciphers are intermixed with the figures in the multiplier.

*RULE.*

Omit the ciphers and place the firft figure of each particular product under its refpective multiplier.

*EXAMPLES.*

```
          804700625
          207008009
          ---------
         7242305625
      6437605000
   5632904375
 1609401250
 ------------------
 166579474222305625
```

| | | |
|---|---|---|
| Multiply | 82164973 by 3027. | Anfwer 248713373271. |
| Multiply | 16358724 by 7040006. | Anfwer 115166398483344. |
| Multiply | 9217600035 by 520007091. | Anfwer 4793217544004081185. |

*CASE.*

4.—When there are ciphers at the right hand of either or both the multiplicand and multiplier.

*RULE.*

Multiply as before, neglecting the ciphers untill all the particular products are added together, and to that fum place the number of ciphers that are on the right hand of both factors.

Multiply

*EXAMPLES.*

| | | | |
|---|---|---|---|
| Multiply . . . | 234000 | 36840 | 3684000 |
| By . . . . . . | 2600 | 230 | 306000 |
| | 1404 | | |
| | 468 | | |
| Product . . . . | 608400000 | 8473200 | 1127304000000 |

If you have any number to multiply by 10, 100, 1000, &c. annex as many ciphers thereto, as there are in the multiplier, and the work is done.

Multiply 1781 by 10. Answer 17810.
Multiply 1781 by 100. Answer 178100.

*CASE.*

5.—When the multiplier is ſuch a number that any two figures or numbers, (in the table) being multiplied together with produce it.

*RULE.*

Multiply the given number by one of thoſe figures or numbers, (which are called component parts) and that product by the other, which will give the deſired product.

*EXAMPLES.*

| | | | | |
|---|---|---|---|---|
| Multiply | 36421 | by 16. | 48612 | by 36. |
| | 4 | times 4 is 16. | 6 | times 6 is 36. |
| | 145684 | | 291672 | |
| | 4 | | 6 | |
| Product | 582736 | | 1750032 | |

Multiply 24574 by 108. Answer 2653992.
Multiply 4364213 by 72. Answer 314223336.
Multiply 78905 by 144. Answer 11362320.

*CASE.*

6.—When the Multiplier is any number between 12 and 20.

*RULE.*

Multiply each figure in the multiplicand, by the figure in the units

place

place of the multiplier, and as you multiply, add to the product of each single figure, that figure of the multiplicand which stands next on the right hand.

*EXAMPLES.*

Let it be required to multiply 954 by 17,

```
  954
   17
 ----
16218
```

Say 7 times 4 is 28, set down 8 and carry 2; then 7 times 5 is 35 and 2 I carried is 37, and the 4 in the units place of the multiplicand makes 41, set down 1 and carry 4; then 7 times 9 is 63 and 4 I carried is 67, and 5 in the multiplicand is 72, set down 2 and carry 7 which being added to 9 in the multiplicand makes 16 to be set down: so the product is 16218.

| | | | | | |
|---|---|---|---|---|---|
| Multiply | 4263 | by | 16. | Answer | 68208. |
| Multiply | 36124 | by | 18. | Answer | 650232. |
| Multiply | 48965 | by | 17. | Answer | 832405. |
| Multiply | 32145 | by | 19. | Answer | 610755. |
| Multiply | 5643 | by | 14. | Answer | 79002. |

*CASE.*

7.—When the multiplier consists of the same figure in all the places that is, all nines, or all sevens, &c.

*RULE.*

For each figure in the multiplier, annex a cipher to the multiplicand, and from that number substract the multiplicand, and if the repeating figure is 9, the remainder is the product; but if any other figure, multiply it into the 9th part of the remainder; or for the figure 3, take the 3d part of the remainder; and for 6, multiply the 3d part by 2.

*EXAMPLES.*

Multiply 47627 by 9999

```
476270000
    47627
---------
476222373
```

Multiply 27464 by 11111

```
 2746400000
      27464
 ----------
9)2746372536
 ----------
  305152504
```

multiply

| Multiply 4674 by 2222 | Multiply 47694 by 7777 |
|---|---|
| 46740000 | 476940000 |
| 4674 | 47694 |
| 9)46735326 | 9)476892306 |
| 5192814 | 52988034 |
| 2 | 7 |
| 10385628 | 370916238 |

Multiply 74760 by 3333. Anſwer 249175080.
Multiply 42763 by 6666. Anſwer 285058158.

## DIVISION OF INTEGERS.

TEACHETH us to find how often one number called the DIVISOR, is contained in another, called the DIVIDEND, and ſerves inſtead of many ſubtractions; the number which ſhews, how often the DIVISOR is contained in the dividend, is called the QUOTIENT.

*CASE.*

1.—When the diviſor is not greater than 12.

*RULE.*

Firſt, ſeek how often the diviſor is contained in the firſt figure of the dividend; or if the firſt figure of the dividend be leſs than the diviſor, then in the two firſt figures of the dividend and ſet the quotient figure down, and if any thing remains carry it to the next figure in the dividend, where it muſt be reckoned as ſo many tens, that is, if 1 remains you

you must call it 10; if 2, 20; and so on; bearing in mind the remainder of each figure, and adding it to the next, until you have made use of all the figures, in the dividend. This is called SHORT DIVISION.

*OBSERVE.*

The remainder must be always less than the divisor.

*PROOF.*

Multiply the quotient by the divisor, and as you multiply add the remainder (if any), or add the whole remainder to the product at last, and if it comes the same as the dividend, the work is right.

*EXAMPLES.*

Divide 57431 by 2.

Place your numbers as follows; when there is a remainder at last, (as in this question) to complete the quotient, set it at the end, above a small line, and set the divisor under it.

```
Divisor Dividend.
     2) 57431
        ------
Quotient 28715½
             2
        ------
Proof.   57431
        ------
```

Divide 76543210 by each number seperately from 3 to 12.

*CASE.*

2.—When the divisor consists of many figures.

*RULE.*

Place your numbers, as follows; then seek, how often the first figure (on the left) of the divisor is contained in the first figure of the dividend; or in the two first figures when that of the divisor is greater, and place the answer in the quotient, by which multiply the divisor, and place the product under the said figures of the dividend, drawing a line underneath it; subtract it therefrom, and to the remainder annex the following figure of the dividend, proceeding as before; but if this product be greater than that part of the dividend, a less figure must be placed in the quotient.

Divisor

| Divisor | Dividend | | Quotient |
|---|---|---|---|
| 83) | 17654 | ( | 212 $\frac{58}{83}$ |
| | 166 | | 83 |
| | 105 | | 636 |
| | 83 | | 1696 |
| | 224 | | 17596 |
| | 166 | | 58 rem. |
| Rem. | 58 | | 17654 proof. |

2.—In case the remainder be so small that when the figure of the dividend joined with it, make a less sum than the divisor, then a cipher is to be placed in the quotient and another figure brought down from the dividend, then proceed as before. This is called LONG DIVISION.

| | | | |
|---|---|---|---|
| 72)74546 | ( | 1035 $\frac{26}{72}$ | |
| 72 | | 72 | |
| 254 | | 2070 | |
| 216 | | 7245 | |
| 386 | | 74520 | |
| 360 | | 26 | |
| Rem. 26 | | 74546 | Proof. |

*EXAMPLES.*

Divide 74638105 by 37. Answer 2017246 $\frac{3}{37}$

Divide 567098 by 648. Answer 875 $\frac{98}{648}$

Divide 987654 by 3065. Answer 322 $\frac{724}{3065}$

Divide 32101234 by 54321. Answer 590 $\frac{51844}{54321}$

Divide 5678901234 by 684573. Answer 8295 $\frac{368199}{684573}$

Divide 3210123456 by 97. Answer 33094056 $\frac{24}{97}$

Divide 3233238699 by 684573. Answer 4723 $\frac{420}{684573}$

Divide 98839054780 by 476085. Answer 207608 $\frac{100}{476085}$

CASE.

*CASE.*

3.—When the divifor has ciphers on the right hand.

*RULE.*

Strike them off, and likewife ftrike off as many places on the right hand of the dividend; and perform the divifion by the remaining figures. And when the divifion is finifhed, annex the figures cut off to the remainder.

When the dividend has the fame number of ciphers on the right hand as the divifor, ftrike them off from each, and the remainder will be fo many of what you divide by, without annexing the ciphers that were cut off.

*EXAMPLES.*

Divide 119282 by 2800

```
28 | 00)1192 | 82(42 1682/2800
        112
        ---
         72
         56
         --
         1682 Remainder.
```

Divide 506500 by 4700

```
47 | 00)5065 | 00(107 36/47
        47
        --
        365
        329
        ---
         36 Remainder.
```

| | |
|---|---|
| Divide 370149 by 20 | Anfwer 18507 $\frac{19}{20}$ |
| Divide 3108690170 by 1200 | Anfwer 2590575 $\frac{17}{120}$ |
| Divide 3108690170 by 7100 | Anfwer 437843 $\frac{487}{710}$ |
| Divide 7380964 by 23000 | Anfwer 320 $\frac{2964}{23000}$ |

*CASE.*

4.—When the divifor is fuch a number, that any two figures or numbers (in the multiplication table), multiplied together, will produce it.

*RULE.*

Divide the given number by one of thofe numbers, or component parts, and that quotient by the other, which will be the anfwer or quotient required.

If there be a remainder in the laft divifion, it will be fo many times the firft divifor, which added to the firft remainder (if any) will give the true remainder.

EXAMPLES.

### *EXAMPLES.*

| Divide 56785 by 84 | Divide 4276 by 48 |
| --- | --- |
| 7 times 12 is 84 | 6 times 8 is 48 |
| 7)56785 | 6)4276 |
| 12)8112   1 | 8)712   4 |
| Answer . $676\frac{1}{84}$ | $89\frac{4}{48}$ |

Divide 42768 by 48. Answer 891.

Divide 74682 by 72. Answer $1037\frac{18}{72}$

Divide 14276 by 144. Answer $99\frac{20}{144}$

Those who are well acquainted with the nature of division, may subtract each figure of the product, as he produces it, and so only write down the remainder, which will shorten the work considerably and is much the best method. Practice will soon make it familiar.

### *EXAMPLES.*

```
17)690489(40617          6125)8649753(1412 1253/6125

   104                        25247
    28                         7475
   119                        13503
     .                   Rem.  1253
```

Divide 5343698 by 84. Answer $63615\frac{38}{84}$

Divide 2148686 by 467. Answer $4601\frac{19}{467}$

Divide 24939844 by 6074. Answer 4106

REDUCTION.

# REDUCTION,

### OF MONEY, WEIGHTS AND MEASURES.

Is the converſion of numbers from one name to another, but ſtill retaining the ſame value.

If the reduction to be a leſs name, it is commonly called REDUCTION DESCENDING, but if to a greater, REDUCTION ASCENDING.

### *RULE.*

Conſider how many of the leſs name concerned make one of the greater, and by that number multiply the given number, if the reduction be deſcending; but divide if aſcending; and the product, or quotient, will be the value in the other name.

### *NOTE.*

1.—When there are names between the propoſed and required one, reduce the propoſed to the next leſs, or greater name, and this to the next leſs, or greater again, and ſo on until you have reduced it to the name required.

2.—When in reduction deſcending the propoſed is a compound number, you muſt add or take in the ſmall numbers in the names below the greateſt to the ſame names, as you proceed in the reduction.

3.—When in reduction aſcending, you have any remainders after dividing, they will have the ſame names as their reſpective diviſors and may be placed after the laſt quotient, according to the order of their names, the greateſt firſt; ſo ſhall the compound number thus formed be the anſwer.



## BENGAL MONEY.

The loweſt ſpecies of money in Bengal is ſea ſhells, called KOREE. Petty retailers in the bazars or markets keep their accounts; alſo, ac-

counts

counts of ſmall diſburſements, as houſe-expences, cooly hire, &c. are kept according to the following table, and is called the KAUCHAU account.

| | | | |
|---|---|---|---|
| ko. | 4 korees . . . . | make . . . . | 1 gundah. |
| gun. | 20 gundahs . . . | make . . . . | 1 pun or pon. |
| pn. | 4 puns . . . . | make . . . . | 1 anna. |
| an. | 4 annas . . . . | make . . . . | 1 kaahun of about |

four to a rupee according to the price of korees in the market, which fluctuates much.

5 gundahs of a kauchau account, are in the bazar called a BOOREE; and 4 puns are generally denominated one CHOK or SEEKEE.

Native merchants and others generally keep their accounts according to the following table, which is denominated the PAUKAU account.

| | | |
|---|---|---|
| 4 quarters . . . . | make . . . . | 1 pauy or pun, commonly called pie. |
| 4 pauys or puns . . | make . . . . | 1 anna. |
| 16 annas . . . . . | make . . . . | 1 taukau, or rupee. |

The generality of European merchants, &c. keep their accounts in ſicca rupees, reckoned thus:

| | | | |
|---|---|---|---|
| pa. | 12 pauy . . . . . . . | make . . . | 1 anna. |
| an. | 16 annas . . . . . . . | make . . . | 1 rupeee. ſa. r. |

European merchants, &c. kept their accounts formerly in current rupees an immaginary coin.

100 Sicca Rupees are equal to 116 Current Rupees.

SEE BATTA.



The coins current in Bengal are gold mohurs, halves and quarters; ſilver ſicca rupees, halves, and quarters; and copper pauys, and half pauys; 4 copper pauys make one anna; and 16 ſicca rupees make

one

one gold mohur, but ſometimes alters according to the ſcarcity of ſilver.

The copper pauys are iſſued from the Treaſury at the rate of 64 for a ſicca rupee, and paſs at that rate in all the Government Offices; but they are current in the bazar and in ſmall payments, generally at 25 gundas each, or 56 to a ſicca rupee, but the rate often alters according to the price of korees.

*EXAMPLES.*

In 44 rupees how many annas?

This reduction is deſcending, ſo I multiply the rupees by 16, becauſe 16 annas make one rupee, and the product is annas.

45
16

Annas 720

Reduce 720 annas to rupees.

This reduction is aſcending, ſo I divide the annas by 16 (in a rupee) and the quotient is the anſwer in rupees, which proves the preceeding example.

16)720

Rupees 45

In 45 rupees how many pauys?

Here I multiply by 16 as before, and the product is 720 annas, which I multiply by 12, becauſe 12 pauys make one anna, and the product is 8640 pauys required. See Note 1.

44
16

720
12

8640

Reduce 8640 pauys, to rupees.

Here I divide by 12 pauys (in one anna) and the quotient is 720 annas, then I divide by 16, as before, and the quotient is the anſwer in rupees.

12)8640

16)720

Rupees 45

Rs. an. pa.
In 565 15 5, how many annas and pauys?

See Rule. Note 2.

565 15 5
16 take in 15

Annas 9055
12 take in 5

Paaee 108665

In 108665 pauys, how many annas and rupees.

12)108665 rem. 5 pa.

See Rule. Note 3.

16) 9055 rem. 15 an.

Answer 565 r. 15 an. 5 pa.

Reduce 1 kaahun; to annas, pur[illegible], gundas and k[illegible]

Answer 4 an. 16 pn. 320 gun. 1280 ko.

In 1280 korees, how many gundas, puns, annas, and kaahun?

Answer 320 gun. 16 pn. 4 an. 1 kaahun.

In 5 kaahun, 2 an. 3 pa. how many puns? Answer 91 puns.

In 91 puns, how many kaahun? Answer 5 kaa. 2 an. 3 pa.

In 1 taakaa, how many korees? Answer 5120 korees.

Reduce 5120 koress; to taakaas? Answer 1 taakaa.

Reduce 28 ficca rupees, 10 an. 6 pa. to pauys. Answer 5502 pauys.

In 5502 pauys; how many ficca rupees? Answer 28 fa. r. 10 an. 6 pa.

[illegible]oo[illegible] ficca rupees, how many pauys? Answer 960000 pauys.

In 55569 fa. r. 6 an. 7 pa. how many pauys? Answer 10669327 pa.

Reduce 597865 pauys, to ficca rupees. Answer 3113 fa. r. 14 an. 1 pa.

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## WEIGHTS.

### GOLD AND SILVER.

| | | | |
|---|---|---|---|
| dh. | 4 dhaans or grains, . . . . | make . . . . | 1 rutty. |
| rut. | 8 rutties, . . . . . . . . | make . . . . | 1 maashaa. |

ma.

ma. 12 maashaas, . . . . . . . make . . . . . 1 tolaa, or sa. wt.
equal to 179 $\frac{2}{3}$ grains troy weight.

*EXAMPLES.*

Reduce 1 tolaa; to mashaas, rutties and dhaans.

Answer 12 maa. 96 rut. 384 dh.

In 5000 dhaans; how many tolaas. Answer 13 tol. 2 rut.

In 6 tolaas, 6 maa. 2 dhs. how many dhaans. Answer 2498.

SMALL BAZAR WEIGHTS.

| | | | |
|---|---|---|---|
| kh. | 4 khaanchaas, . . . . | make . . . . . . | 1 chuttaak. |
| ch. | 4 chuttaaks, . . . . | make . . . . . . | 1 poaa. |
| po. | 4 poaas, . . . . . . . | make . . . . . . | 1 sar. |
| sr. | 5 sars, . . . . . . . | make . . . . . . | 1 patcherry. |
| pat. | 8 patcherries, . . . | make . . . . . . | 1 mon or mun. mn. |

# GREAT WEIGHTS.

## FACTORY WEIGHTS.

According to the Standard received from England in 1787.

| | | | | lb. | oz. | drs. | |
|---|---|---|---|---|---|---|---|
| ck. | 16 chuttaaks . . . | make . . . | 1 sar, equal to | 1 | 13 | 13 . 86 | avoir. |
| sr. | 40 sars, . . . . . | make . . . | 1 mon. mn. | 74 | 10 | 10 . 6 | |

BAZAR WEIGHTS.

| | | | | lb. | oz. | drs. | |
|---|---|---|---|---|---|---|---|
| sa. wt. | 1 sicca weight, . . . . . . . . | | is equal to | 0 | 0 | 6 . 5[illegible]6 | avoir. |
| | 5 sicca weight, . . . | make . . . | 1 chuttaak, | 0 | 2 | 0 . 853 | |
| ck. | 16 chuttaaks, . . . | make . . . | 1 sar, | 2 | 0 | 13 . 853 | |
| sr. | 40 sars, . . . . . | make . . . | 1 mon, | 82 | 2 | 2 . 86 | |

Bazar weight is 10 per cent. more than Factory weight.

See COMPARISON of WEIGHTS.

*EXAMPLES.*

In 5 mons; how many kaanchaas? Answer 12800 khaanchaas.

In 12800 khaanchaas; how many mons? Anſwer 5 mons.

Reduce 66 pat. 4 fr. 3 po. 3 ck. and 3 kh. to khaanchaas. Anſwer 21439 kh.

Reduce 54 fact. mn. to chuttaaks. Anſwer 34560 chuttaaks.

Reduce 34560 chuttaaks; to mons. Anſwer 54 mons.

# MEASURES.

## LONG MEASURE.

| | | | |
|---|---|---|---|
| j. | 3 jow or barley corns . . | make . . . | 1 unglee or finger breadth. |
| ung. | 4 unglees . . . . . . . | make . . . | 1 moot or hand breadth. |
| mt. | 4 moots . . . . . . . | make . . . | 1 haat or cubit. |
| ht. | 4 haats . . . . . . . | make . . . | 1 dunnook or bow's length. |
| dun. | 2000 dunnooks . . . . . | make . . . | 1 kros, about 2¼ English miles. |

The kros alters in different parts of India.

*EXAMPLES.*

Reduce 1 kros; to jows. Anſwer 384000 jows.

Reduce 384000 jows; to kros. Anſwer 1 kros.

## LIQUID MEASURE.

| | | | |
|---|---|---|---|
| ſa. wt. | 5 ſicca weight . . . . . | make . . . . | 1 chuttaak. |
| ch. | 4 chuttaaks . . . . . . . | make . . . . | 1 poaa. |
| po. | 4 poaas . . . . . . . . | make . . . . . | 1 ſar. |
| ſr. | 40 ſars . . . . . . . . . | make . . . . | 1 mon. |

*EXAMPLES.*

Reduce 1 mon; to ſicca weight. Anſwer 3200 ſa. wt.

In 3200 ſa. wt. how many mons; Anſwer 1 mon.

## CLOTH MEASURE.

| | | | |
|---|---|---|---|
| | 3 jows. . . . . . . . . | make . . . . . . | 1 unglee. |
| ung. | 3 unglees . . . . . . . . | make . . . . . . | 1 gheriaa. |

gh.

| | | | |
|---|---|---|---|
| gh. | 8 gheriaas | make | 1 haat or cubit of 18 inches. |
| gt. | 2 haats | make | 1 guz or yard. |

*EXAMPLES.*

In 1 guz how many jows. Anſwer 144 jows.

Reduce 144 jows; to guz. Anſwer 1 guz.

## GRAIN MEASURE.

| | | | |
|---|---|---|---|
| ck. | 5 chuttaaks | make | 1 khoonkee. |
| ko. | 4 khoonkees | make | 1 raik. |
| rk. | 4 raiks | make | 1 paalie. |
| pall. | 20 paalies | make | 1 ſoaalie. |
| ſoa. | 16 ſoaalies | make | 1 kaahun or 40 bazar mons. |

*EXAMPLES.*

Reduce 1 khaahun; to chuttaaks; Anſwer 26500 ck.

In 27500 chuttaaks; how many kaahun. Anſwer 1 kaa.

## LAND OR SQUARE MEASURE.

| | | | |
|---|---|---|---|
| j. | 3 jows | make | 1 unglee. |
| ung. | 4 unglees | make | 1 moot. |
| mt. | 3 moots | make | 1 begot. |
| be. | 2 begots | make | 1 haat or 18 inches. |
| in. | 324 inches | make | 1 ſquare haat or cubit. |

5 cubits long and 4 broad, or 20 ſquare cubits make 1 chuttaak.

16 chuttaaks, or 80 cubits long and 4 cubits broad, or 320 ſquare cubits, make 1 cottaa.

20 cottaas, or 80 cubits ſquare, or 6400 ſquare cubits make 1 beegaa.

A beegaa of Land in Bengall is ſaid to be equal to about 1555 ſquare yards; but RENNELL in his Map of Bengal and Behar, computes at the rate of 1600 ſquare yards, to a ſquare beegaa.

*EXAMPLES.*

In 1 haat; how many jow? Anſwer 72 jows.

Reduce 5 haats, 1 be. 2 mt. 3 ung. 1 j. to jows. Anſwer 430 jows.

## TIME.

| | | |
|---|---|---|
| 18 polloks | make | 1 coſtaa. |

cos.

| | | | | |
|---|---|---|---|---|
| cos. | 30 coſtaas | make | 1 kollaa. |
| kol. | 30 kollas | make | 1 onoopoll. |
| o. p. | 60 onoopolls | make | 1 be poll. |
| b. p. | 60 be polls | make | 1 poll. |
| p. | 60 polls | make | 1 ghurrie or 24 minutes. |
| gh. | 7½ ghurries | make | 1 p,haar or 3 hours. |
| pr. | 8 p,hars | make | 1 day. |
| dy. | 7 days | make | 1 ſaaftaa. |
| | 15 days | make | 1 puhkee. |
| pu. | 2 puhkees | make | 1 mos. |
| ms. | 12 mos. | make | 1 bhaatſaarh or year. |

*EXAMPLES.*

In 1 ghurrie; how many polloks? Anſwer 3499200000.

In 50 gh, [illegible] p, 5 bp, 15 op; how many onoopolls. Anſwer 10980315

## TALE.

| | | |
|---|---|---|
| 4 particulars | make | 1 gundaa. |
| 20 ditto | make | 1 kordge or kooree. |

---

## MADRAS MONEY.

There are a variety of coins in circulation on this coaſt, but the moſt common are the ſilver Arcot rupee, and the Madras gold ſtar pagoda, thus:

| | | | |
|---|---|---|---|
| c. | 10 caſh | make | 1 doodee. |
| d. | 8 doodies | make | 1 fanam. |
| fan. | 12 fanams | make | 1 Arcot rupee. |
| a. r. | 3¼ Arcot rupees | make | 1 ſtar pagoda. ſt. p. |

Government accounts are kept, thus:

| | | | |
|---|---|---|---|
| c. | 80 caſh | make | 1 fanam. |
| fan. | 42 fanams | make | 1 ſtar pagoda. ſt. p. |

This

This is the value at which this coin is iſſued from and taken at the treaſury, but the rate or number of fanams (a ſilver coin) to a rupee or pagoda, fluctuates in the bazar, according to the ſcarcity of ſilver. Merchants, uſually keep their accounts at the rate of 45 fanams to a ſtar pagoda, and the computations in this book are at that rate, unleſs mentioned otherwiſe.

## *EXAMPLES.*

Reduce 52 ſtar pagodas, to caſh. Anſwer 187200 caſh.

In 187200 caſh, how many ſtar pagodas? Anſwer, 52 ſt. p.

Reduce 32 ſt. p. 35 fan. 54 c. to caſh. Anſwer 118054 caſh.

In 118054 caſh; how many ſtar pagodas? Anſwer 32 ſt. p. 35 fan. 54 c.

Reduce 5000 arcot rupees, to caſh. Anſwer 1800000 caſh.

In 1800000 caſh, how many Arcot rupees? Anſwer 5000.

## WEIGHTS.

| | | | | lb. | oz. |
|---|---|---|---|---|---|
| pag. wt. | 10 pagodas weights | make | 1 pollam, equal to | 0 | 1.25 avoir. |
| pol. | 40 pollams | make | 1 viss . . . . . . | 3 | 2 |
| v. | 8 viss . . . | make | 1 mon . . . . . . | 25 | 0 |
| mn. | 20 mons . . | make | 1 candy (can.) | 500 | 0 |

Gold wrought or unwrought to be ſold by the current pagoda weight, equal to 2 dwts 4¼ grs. troy.

## *EXAMPLES*

Reduce 115 candies, to pagoda weights. Anſwer 736000 pag. wt.

In 736000 pag. wt. how many candies. Anſwer 115 candies.

Reduce 35 can. 15 mn. 4v. 25 pol. and 8 pag. wt. to pagoda weights.

Anſwer 2289858 pag. wt.

In 2289858 pag. wt. how many candies? Anſwer 35 can. 15 mn. 4v. 25 pol. 8 pag. wt.

## GRAIN-MEASURE.

| | | | |
|---|---|---|---|
| ol. | 8 olluks . . . . | make . . . . . . | 1 meaſure or puddy. |
| mea. | 8 meaſures . . . | make . . . . . . | 1 marcal. |
| ml. | 5 marcals . . . | make . . . . . . | 1 parah. |
| par. | 80 parahs . . . . | make . . . . . . | 1 garſe. gar. |

When grain is ſold by weight 9256½ lb. avoir. is allowed to a garſe.

EXAMPLES.

*EXAMPLES.*

In 5 garſe; how many olluks? Anſwer 128000 olluks.

Reduce 128000 olluks; to garſe. Anſwer 5 garſe.

Reduce 8 gar. 30 par. 4 ml., 5 mea., and 6 oll.; to olluks.

Anſwer 214702 olluks.

In 214702 olluks; how many garſe?

Anſwer 8 gar. 30 par. 4 ml. 5 mea. 6 ol.

## BOMBAY MONEY,

| | | | | |
|---|---|---|---|---|
| 2 | reas (imaginary) . . . | make . . . . | 1 urdee | |
| 4 | reas . . . | make . . . . | 1 doogany or ſingle pauy. | |
| 6 | reas . . . | make . . . . | 1 doreea. | |
| 8 | reas . . . | make . . . . | 1 luddea or double pauy. | |
| $3\frac{1}{8}$ | luddeas or pauy . | make . . . . | 1 anna. | imaginary. |
| $12\frac{1}{2}$ | pauys or 4 annas . | make . . . . | 1 quarter rupee | imaginary. |
| 25 | pauys or 8 annas . | make . . . . | 1 half rupee. | |
| 50 | pauys or 16 annas . | make . . . . | 1 rupee. | |
| 5 | rupees or 80 annas . | make . . . . | 1 paanchea. | |
| 15 | rupees . . . . . . | make . . . . | 1 gold mohur. | |

Such is the relative table of Bombay current and imaginary coins, while in account they are confined to the following reckoning:

| | | | |
|---|---|---|---|
| r. | 100 reas . . . . . . | make . . . . | 1 quarter. |
| qr. | 4 quarters or 400 reas | make . . . . | 1 rupee (foortee). |

*EXAMPLES.*

Reduce 75 rupees, 2 qrs., 63 reas., to reas. Anſwer 30263 reas.

Reduce 30263 reas; to rupees. Anſwer 75 r. 2 qrs. 63 reas.

## WEIGHTS.

### *SMALL AND SILVER WEIGHTS.*

| | | | |
|---|---|---|---|
| ch. | 6 chowe . . . . . . | make . . . | 1 gonze. |
| go. | $2\frac{1}{2}$ gonze . . . . . . | make . . . | 1 vall. |
| v. | 40 valls . . . . . . | make . . . | 1 tolaa. |
| tol. | 24 tolaas . . . . . . | make . . . | 1 ſar. |

Silver is commonly ſold from 90 to 100 dooganies or ſingle pauys per tolaa, but computations in money are made by the luddeas or double pauys.

## GREAT WEIGHTS.

| | | | | lb. | oz. | drs. |
|---|---|---|---|---|---|---|
| pa. | 30 pauys | make 1 far | equal to | 0 | 11 | 3.2 avoir. |
| fr. | 40 fars | make 1 mon | | 28 | 0 | 0 |
| mn. | 20 mons | make 1 candy | | 560 | 0 | 0 |

See Surat Weights.

*EXAMPLES.*

Reduce 1 candy; to pauys. Answer 24000 pauys.

In 24000 pauys, how many candies. Answer 1 candy.

Reduce 15 can., 5 mn., 15 fr, 15 pa., to pauys. Answer 366465 pa.

In 366465 pauys, how many candies. Answer 15 can. 5 mn. 15 fr. 15 pa.

## GRAIN MEASURE.

| | | | |
|---|---|---|---|
| tip. | 2 tipprees | make | 1 far. |
| fr. | 4 fars | make | 1 adowly or pily. |
| ad. | 16 adowlies | make | 1 parah. |
| ph. | 8 parahs | make | 1 candy. |

This serves for wheat and all grain, except rice and batty, which are sold by the batty measures, but in wholesale, grain is sold by weight.

| | | |
|---|---|---|
| 2 tipprees | make | 1 far |
| $7\frac{1}{2}$ fars | make | 1 adowly. |
| 20 adowlies | make | 1 parah |
| $6\frac{1}{4}$ parahs | make | 1 candy |
| 4 candies or 25 parahs | make | 1 moraà. |

*EXAMPLES.*

Reduce 1 candy, to tipprees (1st table). Answer 1024 tipprees.

In 1024 tipprees; how many candy? Answer 1 candy.

## SURAT WEIGHT.

| | | | lb. | oz. | drs. |
|---|---|---|---|---|---|
| 30 pauys | make 1 far, | equal to | 0 | 14 | 15 |
| 40 fars | make 1 mon, | | 37 | 7 | 6 |
| 20 mons | make 1 candy, | | 749 | 4 | 2 |

Although the foregoing tables represent the commonly received standard of the groſs weights at Bombay, and Surat, it is not only impoſſible to lay down a rule whereby to judge what commodities in the market are ſeparately governed by them; but there is a great variety of articles too numerous to diſtinguiſh here, in the ſale of which the foregoing relations do not obtain, particularly with reſpect to the Surat mon, which, notwithſtanding it is ſaid to contain only 40 ſars or 37 lbs. 7 oz. 6 drs; it is ſometimes 41, 2, 3, through all the intermediate gradations to 46 ſars: nor is the candy uniformly confined to 20 mons; for example, pepper and ſandal wood are ſold by the Bombay candy of 21 mons; and cotton the great ſtaple commodity of the market, by the Surat candy of 21 mons.

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## CHINA.

There is but one piece of coin uſed in China, which is of baſe metal called a CASH, and is uſed to pay labourers and ſmall expences.

### MONEY.

The money, or the weights in which accounts are kept, are thus:

| | | | | l. | s. | d. |
|---|---|---|---|---|---|---|
| c. | 10 caſh | make | 1 candarine, equal to | 0 | 0 | 0¼.2 |
| can. | 10 candarines | make | 1 mace, | 0 | 0 | 8 |
| m. | 10 mace | make | 1 tale or 3 ſa. rs. | 0 | 6 | 8 |
| tale. | 3 tales | make | | 1 | 0 | 0 |

### WEIGHTS.

| | oz. | dwts. | |
|---|---|---|---|
| 100 tales ſhould weigh | 120 | 16. | troy. |
| 100 ſpaniſh dollars | 88 | 13 | |

| | | | lb. | oz. | drs. | |
|---|---|---|---|---|---|---|
| 1 tale weighs | | | 0 | 0 | 19 . 75. | avoir. |
| 16 tales | make | 1 catty | 1 | 3 | 12 | |
| 100 catties | make | 1 pecul | 133 | 5 | 5.28. | |

In China all ſorts of proviſions, as milk, fowls, hogs, greens, &c. are ſold by the catty.

EXAMPLE

*EXAMPLES.*

Reduce 1 tale; to cash. Answer 1000 cash.

In one pecul; how many tales? Answer 1600 tales.

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## ENGLAND.

| | The current coins are as follows: | | lb. | s. | d. | | sa. | r. | a. | pa. |
|---|---|---|---|---|---|---|---|---|---|---|
| Gold | Guineas . . . . . . . . | value | 1 | 1 | 0 | or about | 9 | 0 | 0 | |
| | Half guineas . . . . . . | value | 0 | 10 | 6 | . . | 4 | 8 | 0 | |
| Silver | Shillings . . . . . . . . | value | 0 | 1 | 0 | . . . | 0 | 6 | 10 | |
| | Six pences or half shillings . . | value | 0 | 0 | 6 | . . . | 0 | 3 | 5 | |
| Copper | Half pence . . . . . . . | value | 0 | 0 | 0½ | . . . | 0 | 0 | 3½ | |

### Accounts are kept thus:

| | | | | |
|---|---|---|---|---|
| q. | 4 farthings . . . make . 1 penny | | ¼ is written for 1 farthing. |
| d. | 12 pence . . . make . 1 shilling | | ½ . . . . . 2 |
| s. | 20 shillings . . make . 1 pound sterling. £. | | ¾ . . . . . 3 |

The pound sterling, is an imaginary coin, value about 8 sa. r. 9 an. 2 pa.

*EXAMPLES.*

In 24 pounds; how many pence. Answer 5760 pence.

In 5760 peace; how many pounds. Answer 24 pounds.

In 36 £. 10 s. how many pence? Answer 8760 pence.

In 302 £. 16 s. 4¾ d. how many farthings? Answer 290707 farthings.

In 35040 farthings; how many pounds? Answer 36 £. 10 s.

In 1 pound; how many shillings, pence, and farthings? Answer 20 s. 240 d. 960 farthings.

## WEIGHTS.

*TROY WEIGHT.*

| | | | |
|---|---|---|---|
| gr. | 24 grains . . . | make . . . . | 1 penny weight. |
| dwt. | 20 penny weights . . | make . . . . | 1 ounce. |
| oz. | 12 ounces . . | make . . . . | 1 pound. lb. |

By this weight, gold, silver, Jewels, &c. are weighed.

Note. One grain of troy weight, is equal to 1½ grain of sound dry wheat.

1 lb. 2 oz. 11 dwts. 15¾ gr. troy, is equal to 1 lb. avoirdupois weight.

EXAMPLES.

*EXAMPLES.*

How many ounces, penny weights, and grains; in 37 lb.

Answer 444 oz. 8880 dwts. 213120 grs.

Reduce 213120 grains; to pounds. Answer 37 lb.

In 59 lb. 13 dwts. 5 grs. how many grains. Answer 340157 grs.

## APOTHECARIES WEIGHT.

| | | | |
|---|---|---|---|
| grs. | 20 grains . . . | make . . . | 1 scruple. |
| ℈ | 3 scruples . . | make . . . | 1 dram. |
| ʒ. | 8 drams . . . | make . . . | 1 ounce. |
| ℥. | 12 ounces . . . | make . . . | 1 pound. lb. |

Apothecaries make up their medicines by this weight, but drugs are bought and sold by avoirdupois weight.

*EXAMPLES.*

In 17 lb. how many scruples; Answer 4896 scruples.

In 231 lb. 3 oz. 5 grs. how many grains. Answer 1332005 grs.

In 1332005 grs. how many lbs. Answer 231 lb. 3 ℥. 5 grs.

## AVOIRDUPOIS WEIGHT.

| | | | |
|---|---|---|---|
| dr. | 16 drams . . . . | make . . . . . | 1 ounce. |
| oz. | 16 ounces . . . | make . . . . . | 1 pound. |
| lb. | 28 pounds . . . | make . . . . . | 1 quarter. |
| qrs. | 4 quarters . . . | make . . . . . | 1 hundred weight or 112 lb |
| cwt. | 2- hundred weight . | make . . . . . | 1 ton. |

By this weight all gross goods of a coarse or drossy nature, and all metals, except gold and silver are weighed.

*NOTE.*

| | | | | | |
|---|---|---|---|---|---|
| 1 lb. avoirdupois . . | makes 1 lb. | 2 oz. | 11 dwts. | 15½ grs. troy. |
| 1 oz. . . . . . . . | makes 0 | 0 | 18 dwts. | 5½ grs. |
| 1 dr. . . . . . . . | makes 0 | 0 | 1 dwt. | 3½ grs. |

*EXAMPLES.*

In 15 tons; how many pounds? Answer 33600 lb.

In 9 cwt. 5 lb. how many ounces? Answer 16208 oz.

In 16208 ounces? how many hundred weight. Answer 9 cwt. 5 lb.

MEASURES.

# MEASURES.

## CLOTH MEASURE.

| | | | |
|---|---|---|---|
| na. | 4 nails . . . make . . . 1 quarter of a yard. | yd. |
| qrs. | 3 quarters . : make . . . 1 ell flemish. | ell fl. |
| | 4 quarters . . make . . . 1 yard. | yd. |
| | 5 quarters . . make . . . 1 ell English. | ell eng. |
| | 6 quarters . . make . . . 1 ell French. | ell fr. |
| | 4 quarters $1\frac{1}{5}$ inch make . . . 1 ell Scotch. | ell sc. |

*EXAMPLES.*

In 37 yards ; how many nails ? Answer 592 nails.

Reduce 15 yds. 3 qrs. 1 n., to nails. Answer 253 nails.

In 253 nails , how many yards ? Answer 15 yds. 3 qrs. 1 n.

## LONG MEASURE.

| | | | |
|---|---|---|---|
| b. c. | 3 barley corns . . . . . . | make . . . . . . | 1 inch. |
| in. | 12 inches . . . . . . . . | make . . . . . . | 1 foot. |
| ft. | 3 feet or 36 inches . . . | make . . . . . . | 1 yard. |
| yd. | 2 yards or 6 feet . . . . . | make . . . . . . | 1 fathom. |
| p. | $5\frac{1}{2}$ yards . . . . . . . | make . . . . . . | 1 pole, rod, or perch. |
| fur. | 40 poles or 220 yards . . | make . . . . . . | 1 furlong. |
| m. | 8 furlongs or 1760 yards . | make . . . . . . | 1 mile. |
| lea. | 3 miles . . . . . . . . . | make . . . . . . | 1 league. |
| | $23\frac{5}{6}$ leagues or $69\frac{1}{2}$ miles . . | make . . . . . . | 1 degree. |

360 degrees. is the circumference of the globe.

5 feet, is a geometrical pace.

$16\frac{1}{2}$ feet, is a pole.

ALSO,

| | | |
|---|---|---|
| 4 inches . . . . . | make . . . . . | 1 hand or hand's breadth. |
| 3 hands breadth . . | make . . . . . | 1 foot. |
| $1\frac{1}{2}$ foot . . . | make . . . . . | 1 cubit. |
| 2 cubits . . . | make . . . . . | 1 yard. |

By this measures distances of places or any thing else, that has length only, are measured.

EXAMPLES.

*EXAMPLES.*

In 273 miles; how many inches? Anſwer 17297280 inches.

Reduce 5 m. 6 fur. 3 yds. into inches. Anſwer. 364428 inches.

In 364428 inches; hhw many mils? Anſwer 5 in 6 fur. 3 yds.

## LAND MEASURE.

| | | | |
|---|---|---|---|
| yds. | 5½ yards . . . . . | make . . . . . . | 1 perch, rood, or pole. |
| po. | 40 poles . . . . . . | make . . . . . . | 1 rood. |
| roo. | 4 roods . . . . . . | make . . . . . . | 1 acre. |
| ac. | 30 acres . . . . . | make . . . . . . | 1 yard of land. |

*EXAMPLES.*

In 15 acres; how many poles? Anſwer 2400 poles.

Reduce 27 ac. 1 roo. 32 po. to poles. Anſwer 4392.

## WINE MEASURE.

| | | | |
|---|---|---|---|
| pts. | 2 pints . . . . . . . | make . . . . . . . | 1 quart. |
| qts. | 4 quarts . . . . . . | make . . . . . . . | 1 gallon. |
| galls. | 10 gallons . . . . . . | make . . . . . . . | 1 anchor. |
| galls. | 84 gallons . . . . . . | make . . . . . . . | 1 puncheon. |
| galls. | 63 gallons . . . . . . | make . . . . . . . | 1 hogſhead. |
| hhds. | 2 hogſheads . . . . . | make . . . . . . . | 1 pipe. |
| pp. | 2 pipes . . . . . . . | make . . . . . . . | 1 tun. |

By this meaſure all wines, ſpirits, cyder, &c. are meaſured.

A tun of wine is 18 cwt. avoirdupois.

*EXAMPLES.*

In 19 hogſheads of wine; how many pints? Anſwer 9576 pints.

In 1 pipe of wine, how many quarts? Anſwer 504 quarts.

## ALE AND BEER MEASURE.

| | | | |
|---|---|---|---|
| pts. | 2 pints . . . . . . . | make . . . . . . . | 1 quart. |
| qts. | 4 quarts. . . . . . . | make . . . . . . . | 1 gallon. |
| galls. | 48 gallons of ale . . . | make . . . . . . . | 1 hogſhead. |
| galls. | 54 gallons of beer . . . | make . . . . . . . | 1 hogſhead. |
| hhds. | 2 hogſheads . . . . . | make . . . . . . . | 1 but or 108 gallons. |
| bts. | 2 butts . . . . . . . | make . . . . . . . | 1 tun or 216 gallons. |

EXAMPLES.

### *EXAMPLES.*

In 13 hogsheads of Beer; how many gallons? Answer 702 gallons.

How many hogsheads in 702 gallons of Beer? Answer 13 hogsheads.

## TIME.

| | | | |
|---|---|---|---|
| ‴ | 60 thirds . . . . . | make . . | 1 second. |
| sec. | 60 seconds . . . . . | make . . | 1 minute. |
| min. | 60 minutes . . . . . | make . . | 1 hour. |
| h. | 24 hours . . . . . | make . . | 1 day. |
| d. | 7 days . . . . . | make . . | 1 week. |
| w. | 4 weeks or 28 days. . . | make . . | 1 month. |
| mo. | 52 weeks, 1 day, 6 hours or 13 months, 1 day, 6 hours or 365 days, 6 hours | make . . | 1 Julian year. |

365 days, 5 hours, 48 min. 57 sec. 39‴ make 1 solar year.

The year is divided into 12 unequal calendar months, called January, February, March, April, May, June, July, August, September, October, November, December.

And to know how many days are in each month, observe (to get by heart) the following lines:

Thirty days hath September,<br>
April, June, and November;<br>
February hath twenty-eight alone,<br>
And all the rest have thirty-one;<br>
Except leap-year and then's the time,<br>
February's days are twenty-nine.

### *NOTE*

To find the the leap-year. Divide the given year by 4, if 0 remains, it is leap-year; but if 1, 2, or 3 remains, it is so many years after.

Every fovrth year is leap-year, so called from leaping or advancing a day more that year, than any other; that year has then 366 days in it, and February 29 days.

EXAMPLES.

*EXAMPLES.*

In a calendar month of 30 days; how many hours. Answer 720 hours.

How many minutes are in 1763 months of 28 days each.

Answer 71084160 minutes

How many seconds are in a solar year. Answer 31556937 seconds.

## SQUARE OR SUPERFICIAL MEASURE.

| | | | |
|---|---|---|---|
| 144 | square inches . . | make . . | 1 square foot. |
| 9 | square feet . . | make . . | 1 square yard. |
| 30¼ | square yards . . | make . . | 1 square pole. |
| 40 | square poles . . | make . . | 1 square rood. |
| 4 | square roods . . | make . . | 1 square acre. |
| 640 | square acres or } | . . make . . | 1 square mile. |
| 4840 | square yards } | | |

By this measure all things in which length and breadth are only considered; are measured.

*EXAMPLES.*

Reduce 27 acres, 1 r. 32 po. to poles. Answer 4392 poles.

In 4392 poles, how many acres; Answer 27 ac. 1 r. 32 po.

## SOLID MEASURE.

| | | |
|---|---|---|
| 1728 solid inches . . . | make . . | 1 solid foot. |
| 27 solid feet . . . | make . . | 1 solid yard. |
| 40 solid feet round timber or } | make . . . | 1 solid ton or load. |
| 50 solid feet hewn timber } | | |

By this measure, all things, in which length, breadth, depth or thickness are considered; are measured.

*EXAMPLES.*

In 27 solid yards; how many solid inches? Answer 1259712 in.

In 1259712 solid inches; how many solid yards? Answer 27 yards.

## OF SOME PARTICULAR THINGS.

| | | |
|---|---|---|
| 12 . . . | make . . . . | 1 dozen. |
| 12 dozen . . . | make . . . . | 1 groce. |

12 groce.

| | |
|---|---|
| make . . . . . | 1 great groce. |
| make . . . . . | 1 score. |
| make . . . . . | 1 hundred. |
| make . . . . . | 1 great hundred. |
| make . . . . . | 1 thousand. |

## COMPOUND ADDITION.

IS to add two or more sums or numbers together of the same kind but of different denominations; as, money; weights; &c,

*RULE.*

1.—Place the numbers of a like denomination, under each other, viz. rupees under rupees, annas under annnas, and pauys under pauys.

2.—Begin to add at the lowest denomination, then divide that sum by as many of the same denomination as make one of the next greater, setting down the remainder under the row added, and carry the quotient to the next superior or greater denomination, whose sum you must also find, proceed in this manner to the last, or greatest denomination, which add as in Integers.

*PROOF.*

The same as in addition of Integers.

*EXAMPLES.*

| | kaahun | an. | pu. | gun. | ko. |
|---|---|---|---|---|---|
| | 25 | 3 | 3 | 19 | 3 |
| | 4 | 2 | 2 | 18 | 2 |
| | 13 | 1 | 1 | 17 | 1 |
| | 19 | 0 | 1 | 16 | 2 |
| | 3 | 1 | 0 | 15 | 3 |
| | 18 | 2 | 1 | 14 | 1 |
| | 7 | 3 | 2 | 13 | 0 |
| Sum. | 94 | 3 | 3 | 15 | 0 |

| Sa. r. | an. | pa. | gun. | ko. |
|---|---|---|---|---|
| 15 | 15 | 1 | 13 | 2 |
| 2 | 14 | 2 | 12 | 3 |
| 1 | 13 | 3 | 11 | 1 |
| 17 | 14 | 0 | 10 | 0 |
| 9 | 1 | 2 | 13 | 2 |
| 6 | 8 | 0 | 13 | 1 |
| 7 | 5 | 3 | 11 | 3 |
| 61 | 9 | 3 | 6 | 0 |

| Sa. r. | an. | pa. |
|---|---|---|
| 540 | 15 | 11 |
| 1 | 14 | 10 |
| 15 | 13 | 9 |
| 14 | 12 | 8 |
| 6 | 13 | 7 |
| 5 | 11 | 6 |
| 4 | 10 | 5 |
| 590 | 12 | 8 |

| | tolas | ma. | rut. | dh. |
|---|---|---|---|---|
| | 40 | 11 | 7 | 3 |
| | 5 | 4 | 5 | 2 |
| | 19 | 10 | 3 | 1 |
| | 55 | 9 | 6 | 0 |
| | | 5 | 2 | 3 |
| | 7 | 6 | 5 | 2 |
| Sum | | | | |

| mons. | pat. | fr. | po. | ck. | kh. |
|---|---|---|---|---|---|
| 77 | 7 | 4 | 3 | 3 | 3 |
| 99 | 6 | 3 | 2 | 2 | 2 |
| 66 | 5 | 2 | 1 | 1 | 1 |
| 33 | 4 | 1 | 0 | 0 | 0 |
| 44 | 3 | 0 | 1 | 1 | 1 |
| 88 | 2 | 1 | 2 | 3 | 2 |
| | | | | | |

| mons. | fr. | ck. |
|---|---|---|
| 789 | 39 | 15 |
| 32 | 38 | 14 |
| 5 | 37 | 13 |
| | 36 | 12 |
| 52 | 4 | 3 |
| | 17 | 2 |
| | | |

*NOTE.*

You muſt be carefull to write down the numbers of the ſame denomination exactly under each other, as in the preceding examples, and add them in the ſame manner; only take care to carry from one denomination to another, according to the table pertaining to each particular queſtion.

Add 570 ſa. r., 4 an., 6 pa.; 79 ſa. r., 14 an., 9 pa.; 5 ſa. r., 5 an., 5 pa.; 15 an., 6 pa., 9 pa., 59 ſa. r. 6 an. 7 pa; and 4 ſa. r. 15 an. into one ſum. Anſwer 720 ſa. r. 14 an. 6 pa.

Add 20 mons, 7 pat. 4 fr. 3 po. 3 ck. 3 kh.; 49 mn. 4 pat. 3 fr. 2 po. 3 ck. 2 kh.; 7 mn. 6 pat. 3 fr. 2 po. 2 ck. 1 kh.; and 15 mn. 5 pat. 2 fr. 2 po. 2 ck. 3 kh. into one ſum. Anſwer 94 mn. 1 pat. 1 kh.

Add 155 mons, 35 fr. 5 ck., 16 mn. 7 fr. 15 ck.; 2 mn. 15 fr. 2 ck.; 66 mn. 25 fr. 9 ck.; 576 mn. 15 fr. 15 ck.; and 1700 mons; into one ſum. Anſwer 2517 mons, 19 fr. 14 ck.

Add 15 kaahun, 15 ſoa. 19 paa. 3 rk. 3 khoo. 4 ck.; 3 kaa. 5 ſoa. 15 paa. 1 rk. 2 khoo. 2 ck.; 59 kaa. 3 paa. 3 khoo. 14 ſoa. 9 paa. 2 rk. 2 khoo. 1 ck.; 18 paa. 3 rk. 1 khoo. 3 ck.; 1 rk. 1 khoo. 3 ck.; 2 khoo. 2 ck.; and 3 ck. into one ſum.

Add 15 ſtar pagodas, 44 fan. 7 d. 9 c.; 14 ſt. pag. 43 fan. 6 d. 8 c. 59 ſt. pag. 41 fan. 4 d. 6 c.; 22 ſt. pag. 40 fan. 3 d. 5 c.; and 33 ſt. pag. 39 fan. 2 d. into one ſum. Anſwer 161 ſt. pag. 27 fan. 6 d. 5 c.

Add 555 ſt. pag. 44 fan. 79 c.; 666 ſt. pag. 43 fan. 78 c.; 444 ſt. pag. 42 fan. 77 c.; 333 ſt. pag. 41 fan. 76 c.; and 222 ſt. pag. 40 fan. 75 c. into one ſum. Anſwer 2224 ſt. pag. 34 fan. 65 c.

Add 30 Madras candy, 19 mn. 7 v. 39 pol. 9 pag wt.; 5 can. 18 mn. 6 v. 38 pol. 9 pag. wt.; 6 can. 17 mn. 5 v. 37 pol.; 7 pag. wt. 5 can. 16 mn. 4 v. 36 pol. 6 pag. wt.; and 4 can. 15 mn. 3 v. 35 pol. 5 pag. wt. into one sum.

Answer 74 can. 8 mn. 5 v. 28 pol. 6 pag. wt.

Add 5062 Bombay rupees, 3 qrs. 99 reas.; 22 B. r. 2 qrs. 95 re.; 556 B. r. 2 qrs. 98 re.; 444 B. r. 1 qr. 97 re.; 333 B. r. 3 qrs. 96 re. into one sum.

Answer 6420 B. r. 3 qrs. 85 re.

Add 7 £. 13 s. 3 d; 3 £. 5 s. 10¼ d.; 6 £. 18 s. 7½ d.; 2 s. 5¼ d.; 4 £. 3 d. and 7 £. 15 s. 10¼ d. into one sum. Answer 29 £. 16 s. 4¼ d.

Add 17 lb. 3 oz. 15 dwts. 3 grs.; 4 lb. 6 oz. 15 dwts. 3 grs.; 10 oz. 7 dwts. 21 grs.; 9 lb. 5 oz. 8 grs.; and 76 lb. 2 oz. 17 dwts. into one sum.

Answer 108 lb. 4. oz. 15 dwts. 11 grs.

Add 5 cwt. 3 grs. 27 lb.; 4 cwt. 2 grs. 26 lb.; 3 cwt. 1 qr 25 lb.; 2 cwt. 3 qrs. 24 lb.; 1 cwt. 2 grs. 23 lb. and 1 qr. 22 lb. into one sum.

Answer 19 cwt. 1 qr. 7 lb.

Add 14 lb. 15 oz. 15 drs.; 13 lb. 14 oz. 1 dr.; 12 lb. 13 oz. 2 drs.; 11 lb. 12 oz. 3 drs. and 10 lb. 11 oz. 4 drs. into one sum. Answer 64 lb. 2 oz. 9 drs.

## COMPOUND SUBTRACTION.

Is to find the difference between any two given sums of the same kind but different denominations, as money; weights; &c.

*RULE.*

Subtract as in integers; only when the lower number in any denomination happens to be the greater, borrow one, that is, add as many to the upper number as makes one of the next superior denomination, and then subtract the lower number, and set down the remainder; then carry one and add it to the lower number of the next denomination, and subtract as before.

*PROOF.*

The same as subtraction of Integers.

EXAMPLES.

## EXAMPLES.

| | kaahun | an. | pn. | gun. | ko. |
|---|---|---|---|---|---|
| From | 25 | 2 | 2 | 17 | 1 |
| Take | 5 | 2 | 2 | 18 | 1 |
| Rem. | 19 | 3 | 3 | 19 | 0 |
| Proof | 25 | 2 | 2 | 17 | 1 |

| | Sa. r. | an. | pa. | gun. | ko. |
|---|---|---|---|---|---|
| From | 15 | [illegible] | 2 | 15 | 2 |
| Take | 6 | 14 | 2 | 16 | 3 |
| | | | | | |
| | | | | | |

| | Sa. r. | an. | pa. |
|---|---|---|---|
| From | 449 | 15 | 10 |
| Take | 14 | 15 | 11 |
| | | | |
| | | | |

| | Sa. r. | an | pa. |
|---|---|---|---|
| From | 5000 | 0 | 0 |
| Take | 79 | 15 | 9 |
| Difference | | | |

| | Sa. r. | an. | pa. |
|---|---|---|---|
| From | 55 | 14 | 6 |
| Take | 54 | 15 | 9 |
| | | | |

| | Sa. r. | an. | pa. |
|---|---|---|---|
| From | 560 | 0 | 5 |
| Take | | 10 | 0 |
| | | | |

| | Mon. | pat. | fr. | po. | ck. | kh. |
|---|---|---|---|---|---|---|
| From | 4 | 5 | 2 | 1 | 1 | 1 |
| Take | 3 | 6 | 3 | 2 | 3 | 2 |
| Remainder | | 6 | 3 | 2 | 1 | 3 |

| | Mon. | fr. | ck. |
|---|---|---|---|
| From | 55 | 16 | 15 |
| Take | 19 | 20 | 4 |
| | | | |

| | Mon. | pat. | fr. | po. | ck. | kh. |
|---|---|---|---|---|---|---|
| From | 25 | 0 | 0 | 2 | 3 | 2 |
| Take | 6 | 0 | 0 | 3 | 0 | 3 |
| | | | | | | |

| | St. pag. | fan. | d. | c. |
|---|---|---|---|---|
| Borrowed | 14 | 16 | 6 | 6 |
| Paid | 10 | 44 | 7 | 7 |
| Remains | 3 | 16 | 6 | 79 |

| | St. pag. | fan. | c. |
|---|---|---|---|
| Borrowed | 66 | 5 | 17 |
| Paid | 59 | 40 | 72 |
| Remains | 6 | 9 | 25 |

| | St. pag. | fan. | d. | c. |
|---|---|---|---|---|
| Borrowed | 78 | 15 | 3 | 5 |
| Paid | 57 | 43 | 4 | 6 |
| Remains | | | | |

| | St. pag. | fan. | c. |
|---|---|---|---|
| Borrowed | 5 | 20 | 18 |
| Paid | | 40 | 19 |
| Remains | | | |

| | Mad. can. | mn. | v. | pol. | pag. wt. |
|---|---|---|---|---|---|
| Bought | 59 | 15 | 3 | 25 | 5 |
| Sold | 19 | 19 | 7 | 39 | 9 |
| Remains | 39 | 15 | 3 | 25 | 6 |

| | Mad can. | mn. | v. | pol. | pag. wt. |
|---|---|---|---|---|---|
| Bought | 45678 | 0 | 0 | 15 | 5 |
| Sold | 26399 | 1 | 1 | 16 | 6 |
| | | | | | |

| | Bom. | r. | qrs. | reas. | Bom. | r. | qrs. | reas. | Bom. | r. | qrs. | reas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From. 1 | 50790 | | 2 | 79 | [illegible]7 | | 0 | 0 | 576 | | 2 | 99 |
| Take | 29491 | | 3 | 76 | [illegible] | | 3 | 55 | 575 | | 3 | 99 |
| Remains | 21298 | | 2 | 94 | | | | | | | | |

| | £. | s. | d. | £. | s. | d. | £. | s. | d. |
|---|---|---|---|---|---|---|---|---|---|
| Borrowed | 142 | 17 | 6¼ | 7779 | 15 | 1 | 5555 | 17 | 3½ |
| Paid | 12 | 4 | 6½ | 880 | 16 | 2¼ | 4666 | 18 | 5 |
| Unpaid | 130 | 12 | 11¾ | | | | | | |

| | lb. | oz. | dwts. | grs. | cwt. | qrs. | lb. | lb. | oz. | drs. |
|---|---|---|---|---|---|---|---|---|---|---|
| Bought | 14 | 10 | 12 | 17 | 50 | 2 | 17 | 7543 | 15 | 12 |
| Sold | 11 | 11 | 14 | 21 | 15 | 3 | 18 | 6634 | 5 | 13 |
| Remains | | | | | | | | | | |

## COMPOUND MULTIPLICATION.

TEACHETH to multiply (by one common multiplier) any sum or number consisting of divers denominations.

*CASE.*

1.—When the given quantity does not exceed 12.

*RULE.*

1.—Write the multiplier or given quantity under the lowest denomination of the multiplicand.

2.—Begin at the lowest denomination, and multiply it by the given number, and see how many of the next denomination is contained in the product, set down the remainder underneath its own place and add the quotient to the next superior denomination, as you multiply, in this manner, proceed with all the other denominations to the highest.

EXAMPLES.

*EXAPMLES.*

| | Sa. r. an. pa. gun. ko. | | | | | Sa. r. an. pa. | | | Sa. r. an. pa. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Multiply | 5 | 13 | 2 | 15 | 2 | 500 | 14 | 6 | 560 | 0 | 10 |
| By | | | | | 3 | | | 4 | | | 5 |
| Product | 17 | 9 | 0 | 6 | 2 | 2003 | 10 | 0 | 2800 | 4 | 2 |

Multiply 54 sa. r., 9 pa.; by 5. Answer 270 sa. r. 3 an. 9 pa.

6 garce of rice, at 59 st. pag. 14 fan. 55 c. per g. Answer 355 pag. 43 fan. 10 c.

7 candies of wheat, at 105 Bom. r. 3 qrs. 70 reas each.

Answer 741 r. 1 q. 90 reas.

12 dozen of wax candles, at 6 s. 8 d. per dozen. Answer £. 4 0 0.

11 barrels of beer, at 10 s. 6 d. per bar. Answer 5 £. 15 s. 6 d.

10 mons of ghee, at 3 sa. r. 6 an., per mon. Answer 33 sa. r. 12 an.

9 mons of sugar, at 6 sa. r. 5 an. 4 p. per mon. Answer 57 sa. r.

*CASE.*

2.—When the multiplier or given quantity exceeds 12, and is such a number, that any two figures or numbers (in the Multiplication Table) being multiplied together, will produce it.

*RULE.*

Multiply the given price by one of those numbers, and the product by the other, which will give the answer.

*EXAMPLES.*

What will 56 mons of wheat cost, at 4 sa. r. 6 an. 6 pa. per mon?

| | | | | |
|---|---|---|---|---|
| | 4 | 6 | 6 | |
| | | | 7 | times 8 is 56. |
| | 30 | 13 | 6 | |
| | | | 8 | |
| Sa. r. | 246 | 12 | 0 | Answer. |

What will 28 mons of tallow candles cost, at 44 sa. r. 14 an. 6 pa. per mon.

| | | | | |
|---|---|---|---|---|
| | 44 | 14 | 6 | |
| | | | 4 | times 7 is 28 |
| | 179 | 10 | 0 | |
| | | | 7 | |
| Sa. r. | 1257 | 6 | 0 | Answer. |

84 mons of fug[illegible] 22 ft. pag. 34 fan. 45 c. per mon. Anfwer 1457 pag. 7 fan.
35 mons of [illegible], at 68 Bom. r. 2 qrs. 5 reas, per mon. Anfwer 2397 B. r. 3 q. 75 r.
55 cwt. of fugar, at 5 £. 14 s. 6 d. per cwt. Anfwer 314 £. 17 s. 6 d.
18 lb. of butter, at 4½ per lb. Anfwer 6 s. 9. d.
144 lb. of tea, at 4 s. 6 d. per lb. Anfwer 32 £. 8 s.

*CASE.*

3.—When the given quantity cannot be produced by the multiplication of any two fmall numbers.

*RULE.*

Find the next lefs number, and multiply as before; then for what is wanting, multiply the price by that number, and add it to the laft product, and the fum will be the anfwer.

*EXAMPLES.*

What will 38 mons of fugar come to, at 6 fa. r. 14 an. 6 pa. per mon?

| | | | | |
|---|---|---|---|---|
| | 6 | 14 | 6 | |
| | | | 6 | times 6 is 36 and 2 is 38 |
| | 41 | 7 | 0 | |
| | | | 6 | |
| | 243 | 10 | 0 | |
| | 13 | 13 | 0 | twice the given price. |
| Sa. r. | 262 | 7 | 0 | Anfwer. |

What will 19 fars of Tea coft. at 5 r. 4 an. 3 pa. per far?

| | | | | |
|---|---|---|---|---|
| | 5 | 4 | 3 | |
| | | | 2 | times 9 is 18 and 1 is 19 |
| | 10 | 8 | 6 | |
| | | | 9 | |
| | 94 | 12 | 6 | |
| | 5 | 4 | 3 | once the given price. |
| Rs. | 100 | 0 | 9 | Anfwer |

38 pair of ftockings, at 3. r 5 an. per pair. Anfwer 125 r. 14 an.
46 pair ditto, at 8 r. 5 an. 6 pa. per pair. Anfwer 383 r. 13 an.

29 yards of Cloth, at 6 r. 7 an. per yd. Answer 186 r. 11 an.

58 mons of sugar, at 3 st. pag. 15 fan. per mon. Answer 193 st. pag. 15 fan.

29 candys of rice, at 12 Bom. r. 3 qrs. 10 reas per can. Answer 370 r. 1 qr. 90 reas.

65 sheep, at 1 £. 5 s. 4 d. each. Answer 82 £. 6 s. 8 d.

75 dozen of soap, at 6 s. 3½ per doz. Answer 23 £. 11 sh. 10½ d.

86 dozen of stockings, at 2 £. 4 s. 2 d. per doz. Answer 189 £. 18 s. 4 d.

106 cwt. of raisins; at 12 sa. r. 15 an. 4 pa. per cwt. Answer 1373 r. 9. an. 4 pa.

*CASE.*

4.—When the given quantity consists of ¼, ½, or ¾;

*RULE.*

Divide the upper line (the price of one) by 4 for ¼; by 2 for ½; by 2 first for ¾: then divide that quotient by 2 for ¼; add them to the product, and the sum will be the answer.

*EXAMPLES.*

5¼ sr., at 1 r. 2 an. 5 pa. per sr.

```
 4)  1   2   5
             5
    -----------
     5  12   1
         4   7¼
    -----------
Sa. r. 6  0  8¼  Answer
```

7½ lb. at 6 s. 6 d.

```
 2)  6   6
         7
    -------
 2   5   6
     3   3
    -------
£ 2  8   9  Answer
```

5¾ mons, at 2 r. 2 qrs. 5 reas.

```
 2)  2   2   5
             5
    -----------
    12   2  25
 2)  1   1   2½
         2  51¼
    -----------
Bo. r. 14  1  78¾
```

The foregoing methods, of finding the value of any quantity of goods under 100, at any price per mon, sar, pound, &c. is of excellent use in retail business.

But for great quantities, there are other methods much better. (See PRACTICE).

NOTE.

*NOTE.*

Weights, measures, &c. are multiplied after the same manner as money, only you must be carefull to carry according to each denomination or table pertaining thereto.

Multiply 66 bazar mons, 35 sr., 14 ck.; by 9. Answer 602 mn. 2 sr. 14 cks.

Multiply 17 cwt. 24 lb.; by 12. Answer 206 cwt. 2 qrs. 8 lb.

Multiply 14 lb. 10 oz. 21 grs.; by 7. Answer 103 lb. 10 oz. 6 dwts. 3 grs.

Multiply 49 baz. mons. 15 sr. 15 ck. by 99. Answer 4890 mn. 17 sr. 13 ck.

Multiply 15 cwt. 3 qrs. 16 lb. by 72. Answer 1144 cwt. 1 qr. 4 lb.

## COMPOUND DIVISION.

TEACHETH to divide by one common divisor, either a simple or compound number, into any proposed number of equal parts whereof each shall be a compound number.

*CASE.*

1.—When the divisor doth not exceed 12.

*RULE.*

1.—Place the divisor and dividend, as in integers, writing the quotien under each respective dividend.

2.—Begin at the highest denomination, which divide by the given divisor, and set the answer in the quotient and to be of the same denomination; if there be a remainder, you must find how many of the next lower denomination it is equal to, and add to the given number of that denomination in the dividend, divide as before. Proceed thus through all the denominations.

*EXAMPLES.*

Divide 55 sa. r. 15 an. 5 pa. between 2 persons.

First I divide the integers 55 by 2, and the quotient is 27 and 1 remains, which remainder (1) reduced to the next lower denomination makes 16 annas and those added to 15 an. in the devidend make 31 annas, which divided by 2, gives 15 an. to the quotient and 1 anna remains; which is equal to 12 pauys and those added to 5 pa. in the dividend make 17 which divided by 2, gives 8 pa. to the quotient and 1 or ½ pauy remains.

| | | | |
|---|---|---|---|
| | 2)55 | 15 | 5 |
| Answer Rs. | 27 | 15 | 8½ |
| | | | 2 |
| Proof Rs. | 55 | 15 | 5 |

Divide

Divide 77 fa. r. 14 an. 3 pa.; by 3. Anfwer 25 fa. r. 15 an. 5 pa.

Divide 19 fa. r. 13 an. 2 pa.; by 4. Anfwer 4 fa. r. 15 an. 3 $\frac{2}{4}$

Divide 5 kahun, 3 an. 3 pn. 15 gun. 3 ko.; by 5. Anfwer 1 ka. 3 pn. 3 gun o ko. $\frac{3}{5}$

Divide 13 fa. r. 6 an. 3 pn. 4 gun. 2 ko.; by 6.

Anfwer 2 r. 3 an. 3 pn. 4 gun. o ko. $\frac{2}{6}$

Divide 15 Ar. r. 3 fan. 50 c.; by 7. Anfwer 2 Ar. r. 2 fan. 18 c. $\frac{4}{7}$

Divide 52 ft. pag. 13 fan. 50 c.; by 8. Anfwer 6 pag. 27 fan. 76 c. $\frac{2}{8}$

Divide 17 Bom. r. 2 qr. 55 reas; by 9. Anfwer 1 r. 3 qrs. 83 c. $\frac{8}{9}$

Bought 4 cwt. of cheefe, for which I give 8 £. 10 s. 4 d.; what did it coft per cwt.

Anfwer 2 £. 2 s. 7 d.

If 10 dozen of candles coft 3 £. 17 s. 1 d. what is the price of one dozen.

Anfwer 7 s. 8½ d.

*CASE.*

2.—When the divifor exceeds 12. and is fuch a number that any two figures or numbers (in the Multiplication Table) will product it.

*RULE.*

Divide the given fum by one of thofe numbers, and that quotient again by the other, which will give the anfwer.

*EXAMPLES.*

Divide 45 fa. r. 15 an. 5 pa. by 16.

4 times 4 make 16. 4)45 15 5

4)11 7 10 1 rem.

Sa. r. 2 13 11 $\frac{9}{16}$ Anfwer.

Divide 77 fa. r. 3 an. 5 pa.; equally amongft 44 perfons. Anfwer 1 r. 12 an 9 $\frac{29}{44}$ pa.

Divide 45 fa. r. 4 an. 2 pa. 6 gun. 3 ko., between 72 coolies.

Anfwer 10 an. 5 gun. o ko. $\frac{27}{72}$

Bought

Bought 80 mons of rice for 120 Ar. r. 9 fan. 6 c.; what did it cost per mon.

Anfwer 1 r. 6 fan. 9 c.

A quantity of fugar fold for 540 ft. pag. 44 fan. 79 c.; which muft be equally divided between 81 perfons; how much is each perfons fhare?

Anfwer 6 pag. 30 fan. 44 c. $\frac{35}{81}$

It is required to divide 375 Bom. r. 2 qrs. 99 reas, between 121 perfons; what is each perfons fhare? Anfwer 4 r. 3 qrs. 3 reas $\frac{36}{121}$

Divide 7 £. 6 s. equal between 24 perfons? Anfwer 6 s. 1 d.

What is cloth per yard, when 36 yards coft 64 £. 19 s. Anfwer 1 £. 16 s. 1 d.

*CASE.*

3.—When the divifor cannot be produced by the Multiplication of any two fmall numbers.

*EXAMPLES.*

Divide 55679 fa. r. 14 an. 6 pa. by 549

```
549)55679 14 6 (101 fa. r. 6 an. 8 414/549 pa. Anfwer.
    ------
rem. 230
      16
    ----
549)3694 (6 annas
    ----
rem. 400
      12
    ----
549)4806 (8 pauys
    ----
rem. 414
    ----
```

Here, I divide the Integers firft, which gives the quotient 101 rupees being the fame denomination as the Integers of the dividend; then multiply the remainder 230 by 16 (annas in a rupee), being the next lower denomination, and take in the (15) annas given in the dividend, and divide the product by the fame divifor, which gives 6 annas to the quotient, being the fame denomination as you multiplied by; then again multiply the remainder 400 by 12 (pauys in one anna), taking in the 6 pauy from the dividend, which product divide as before, which gives 8 pa. to the quotient and 414 remainder; laftly, place the feveral quotients in regular order as above, gives the anfwer complete.

Divide

Divide 1054350 fa. r. 15 an. 6 pa., equaly between 1000 men.

Answer 1054 fa. r. 5 an. 7 pa. $\frac{386}{1000}$.

A frigate took a prize, worth 5562 £. 15 s. 6 d., to be divided equally between 215 men, what is each man's share? Answer 25 £. 17 s. 5 d. $\frac{131}{215}$.

Division of weights, &c. is worked in the same manner, with ease and accuracy, paying a due regard to their different denominations, according to the Tables.

## CHARACTERS USED IN ARITHMETIC.

+ plus, or more, the sign of Addition; as 3+4, signifies 3 added to 4.

- - minus, or less the sign of Subtraction; as 4—2, signifies 2 subtracted from 4.

× the sign of Multiplication; 3×4, signifies 3 multiplied by 4.

÷ the sign of Division, as 9÷3, signifies 9 divided by 3. This is somtimes expressed thus $\frac{9}{3}$.

== the sign of equality; as, 3+4=7, signifies 3 added to 4 is equal to 7.

: : : . the sign of arithmetical proportion; as 2 : 4 : : 6 : 12. signifies as 2 . is to 4 : : so is 6 : to 12.

*EXAMPLE.*

(+)—3×5÷2==30; signifies 9 added to 6, from the sum subtract 3, the remainder multiplied by 5, and that product divided by 2, is equal to 30.

## VULGAR FRACTIONS.

A FRACTION is some part or parts of an Integer, or whole thing represented by 1; as $\frac{3}{4}$ is a fraction, denoting three-fourths of any thing, or parts of an integer or 1. Every fraction consists of two numbers, placed one above the other, with a line between them; as in the fraction $\frac{2}{3}$; the lower number 3 is called the DENOMINATOR, and shews how many parts the Integer is divided into; the upper number 2 is called the NUMERATOR, and expresses how many of these parts the fraction consists of. And both numerator and denominator are called TERMS OF THE FRACTION.

A

A vulgar fraction, is either proper, improper, single, compound or [illegible]

A proper fraction, is that wherein, the numerator is less than the denominator, as $\frac{3}{4}$.

An improper fraction, is such whose numerator is equal to, or greater than its denominator; as $\frac{3}{3}$; $\frac{4}{3}$.

A single fraction, is that which consists of but one numerator and one denominator and is referred immediately to some integer; as $\frac{3}{4}$ or $\frac{1}{2}$ of any thing.

A compound fraction, is the fraction of a fraction, consisting of two or more simple fractions, referred to one another in order, and the last, referred to some integer; as $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{6}$ &c.

A mixed number, is composed of a whole number and a fraction; as $6\frac{1}{2}$, $34\frac{2}{3}$, $152\frac{6}{8}$, &c.

---

## REDUCTION OF VULGAR FRACTIONS.

*CASE.*

1.—TO reduce a fraction to another of equal value.

*RULE.*

Multiply or divide both terms of the fraction, by the same number and you will have a new fraction, equal to that given.

*EXAMPLE.*

Let the given fraction be $\frac{4}{6}$, now (per rule) multiply both terms by 5, thus:

```
 6    4
 5    5
 —    —
20   30, whence the new fraction 20/30 equal to 4/6
```

again, divide both terms of the fraction by 5, thus.

$$5\Big)\frac{20}{30}\Big(\frac{4}{6} \text{ the fraction given.}$$

CASE.

### *CASE.*

2.—To reduce a whole number to an improper fraction.

### *RULE.*

Set 1 under it for a denominator.

### *EXAMPLE.*

Suppose 8, 4, 6, 36, were numbers to be reduced to fractions.

Then (per rule) $\frac{8}{1}, \frac{4}{1}, \frac{6}{1}, \frac{36}{1},$ the fractional quantity required.

### *CASE.*

3.—To reduce a whole number to a fraction of a given denominator.

### *RULE.*

Multiply [illegible] number by the given denominator, and under the product [illegible] nominator.

### *EXAMPLE.*

[illegible] n, whose denominator shall be 6.

[illegible], then $\frac{54}{6}$ is the fraction required.

### *NOTE*

The preceding three cases being so exceedingly easy, more than one example in each case, would be quite unnecessary.

### *CASE.*

4.—To find the greatest common measure or divisor, for the numerator and denominator, of any given fraction, or for any two numbers.

### *RULE.*

Divide the greater term by the lesser, and the last divisor by the remainder, and so on continually till nothing remain, the last divisor is the common measure required.

### *NOTE.*

If the last remainder is 1, the fraction is already in its lowest terms.

EXAMPLES.

*EXAMPLES.*

What is the greatest common measure of $\frac{252}{364}$?

Answer 28 which is the last divisor, and is the greatest number that will divide the numerator and denominator without a remainder.

```
     252)364(1
         252
         ---
     112)252
         224
         ---
Answer 28)112(4
          112
          ---
            0
```

What is the greatest number that will divide the numbers 336 and 896, without leaving a remainder? Answer 112.

What is the greatest common measure of $\frac{144}{560}$? Answer 16.

What is the greatest common measure of $\frac{1476}{1035}$? Answer 6.

*CASE.*

5.—To reduce a fraction to its least or lowest terms.

*RULE.*

Find the greatest common measure by the preceding case; then divide both terms of the fraction by it, the quotients will be the answer required.

*EXAMPLES.*

Reduce $\frac{192}{336}$ to its lowest terms.

```
                         192)336(1
                            144)192(1
greatest common divisor       48)144(3
                                 ---
                                   0
```

then 48) $\frac{192}{336}$ ( $\frac{4}{7}$ Answer.

Reduce $\frac{336}{896}$ to its lowest terms. Answer $\frac{3}{8}$

Reduce $\frac{2832}{22848}$ to its lowest terms. Answer $\frac{477}{603}$

*CASE.*

6.—To reduce a compound fraction to a single fraction of the same value.

RULE.

*RULE.*

Multiply all the numerators, together for a new numerator, and all the denominators for a new denominator; then reduce the new fraction to its lowest terms by the preceding case.

*EXAMPLES.*

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$, to a single fraction. $\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}=\frac{24}{60}$ or $\frac{2}{5}$.

$$\begin{array}{ccc} 2 & & 3 \\ 3 & & 4 \\ \hline 6 & & 12 \\ 4 & & 5 \\ \hline 24 & & 60 \end{array}$$

numerator 24. denominator 60, then $\frac{24}{60}$ is the single fraction, which being reduced to its lowest terms, by the last case is equal to $\frac{2}{5}$ Answer.

Reduce $\frac{4}{9}$ of $\frac{5}{7}$ of $\frac{9}{10}$, to a single fraction. Answer $\frac{2}{7}$.

Reduce $\frac{2}{9}$ of $\frac{3}{4}$ of 4, to a single fraction. Answer. $\frac{2}{3}$

Reduce $\frac{3}{7}$ of $\frac{1}{3}$ of $\frac{7}{8}$, to a single fraction. Answer $\frac{1}{8}$

*CASE.*

7.—To reduce any mixed number to an improper fraction.

*RULE.*

Multiply the whole number by the denominator of the fraction, and to the product add the numerator, which sum place over the given denominator.

*EXAMPLES.*

Reduce 26 $\frac{3}{8}$ to an improper fraction. $26\times8+3=211$ or $\frac{211}{8}$

$$\begin{array}{c} 26\ \frac{3}{8} \\ 8 \\ \hline \end{array}$$

Num. 211, then $\frac{211}{8}$ is the fraction required.

Reduce 4 $\frac{2}{7}$ to an improper fraction. Answer $\frac{30}{7}$.

Reduce 16 $\frac{1}{2}$ to an improper fraction. Answer $\frac{33}{2}$.

Reduce

Reduce 142 $\frac{17}{23}$ to an improper fraction. Answer. $\frac{3283}{23}$

*CASE.*

8.—To reduce an improper fraction, into its equivalent or proper terms.

*RULE.*

Divide the numerator by the denominator, the quotient gives the whole number, and under the remainder (if any) subscribe the denominator.

*EXAMPLES.*

Reduce $\frac{211}{8}$, to its proper terms. $211 \div 8 = 26\frac{3}{8}$

$$8)211$$
$$\overline{26\tfrac{3}{8}} \text{ Answer.}$$

Reduce $\frac{30}{7}$, to its proper terms. Answer. $4\frac{2}{7}$

Reduce $\frac{33}{2}$, to its proper terms. Answer $16\frac{1}{2}$.

*CASE.*

9.—To reduce fractions of different denominations to fractions of equal value, that shall have one common denominator.

*RULE.*

Multiply each numerator by all the denominators, except its own for a new numerator, then multiply all the denominators together for a common denominator.

*EXAMPLES.*

Reduce $\frac{2}{3}$, $\frac{3}{4}$ and $\frac{4}{5}$, to a common denominator

or thus.

$2 \times 4 \times 5 = 40$ num.
$3 \times 3 \times 5 = 45$ num.
$4 \times 4 \times 3 = 48$ num.
$3 \times 4 \times 5 = 60$ den.

| 2 | 3 | 4 | 3 |
|---|---|---|---|
| 4 | 3 | 4 | 4 |
| 8 | 9 | 16 | 12 |
| 5 | 5 | 3 | 5 |
| 40 num. | 45 num. | 48 num. | 60 den. |

Therefore

Therefore $\frac{2}{3}=\frac{40}{60}$; $\frac{3}{4}=\frac{45}{60}$; $\frac{4}{5}=\frac{48}{60}$, Anſwer.

Reduce $\frac{3}{4}$, $\frac{11}{12}$ and $\frac{7}{10}$, to a common denominator. Anſwer. $\frac{360}{480}$; $\frac{440}{480}$; $\frac{336}{480}$.

Reduce $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of $\frac{7}{8}$, to a common denominator.

Anſwer. $\frac{960}{2880}$, $\frac{720}{2880}$, $\frac{576}{2880}$, $\frac{420}{2880}$.

Reduce $\frac{5}{6}$, $\frac{7}{10}$, $\frac{3}{4}$, and $\frac{3}{4}$, of 3, to a common denominator.

Anſwer $\frac{800}{960}$ $\frac{672}{960}$ $\frac{720}{960}$ and $\frac{240}{960}$.

Reduce 14 $\frac{2}{3}$, 7, and $\frac{2}{3}$ of $\frac{5}{8}$ and $\frac{4}{7}$ to one common denominator.

Anſwer $\frac{11088}{756}$ $\frac{5292}{756}$ $\frac{105}{756}$ and $\frac{432}{756}$.

*CASE.*

10.—To reduce money, weights, meaſures, &c. into fractions.

*RULE.*

Reduce the given quantity to the loweſt name or denomination mentioned and make it the numerator; then reduce the Integer, of which the given quantity is a part, to the ſame denomination, and make it your denominator, then reduce that fraction to its loweſt terms, by caſe 5, which is the fraction required.

*EXAMPLES.*

Reduce 8 an. 10 pa. to the fraction of a rupee.

8 10 then 16 an. in a rupee.
12 12

Num. 106 den. 192, the fraction is $\frac{106}{192}$, which reduced to its loweſt terms, is $\frac{53}{96}$ Anſwer.

Reduce 15 fan. 20 c. to the fraction of a pagoda. Anſwer $\frac{61}{160}$ pag.

Reduce 10 an. 8 pa. to the fraction of a rupee. Anſwer $\frac{15}{16}$ r.

Reduce 4 s. 2$\frac{1}{2}$ d. to the fraction of a pound ſterling. Anſwer $\frac{101}{120}$ £.

Reduce 5 far. 15 ck. to the fraction of a mon. Anſwer $\frac{19}{128}$ mon.

Reduce 19 Bom. mds. 15 sr. 15 pa. to the fraction of a Bombay candy. Answer $\frac{223}{1200}$

Reduce [illegible] mons. 5 v. 5 pol. 5 pag. wt. to the fraction of a Madras candy.

Answer $\frac{2331}{32000}$ can.

Reduce 2 qr. 4 lb. to the fraction of 1 cwt. Answer $\frac{-}{7}$ cwt.

Reduce 6 oz. 17 dwt. 21 gr. to the fraction of a lb. troy wt. Answer $\frac{3309}{5760}$ lb.

Reduce 3 qrs. 3 lb. 1 oz. 12 drs. to the fraction of a cwt. Answer. $\frac{5575}{6918}$ cwt.

*NOTE.*

Any other money, weights, &c. may be reduced to fractions, in the same manner, proper attention being paid to the tables of the different denominations.

*CASE.*

11.—To reduce fractions of one denomination to another retaining the same value.

*RULE.*

1.—If the fraction given is to be brought from a less to a greater denomination; multiply the denominator by the several parts contained in the several denominations between it, and that you would reduce it to, for a new denominator, which placed under the given numerator will give the new fraction, which reduce to its lowest terms.

2.—If the fraction given is to be brought from a greater to a less denomination, then multiply the numerator in the same manner as you did before the denominator, and place it over the given denominator, and it will give the new fraction, which also reduce to its lowest terms.

*EXAMPLES.*

Reduce $\frac{3}{8}$ of a pauy, to the fraction of a rupee.

$$\begin{array}{r} 8 \\ 12 \\ \hline 96 \\ 16 \\ \hline 1536 \end{array}$$

1536, the new fraction is $\frac{3}{1536}$ or $\frac{1}{512}$ r. its lowest terms.

Reduce

Reduce $\frac{1}{512}$ of a rupee ficca, to the fraction of a pany.

$1 \times 16 \times 12 = 192$, the new fraction is $\frac{192}{512}$ or $\frac{3}{8}$ pa. its lowest terms.

Reduce $\frac{1}{620}$ of a pound sterling, to the fraction of a penny. Answer $\frac{12}{31}$ d.

Reduce $\frac{5}{7}$ of a penny, to the fraction of a pound. Answer $\frac{1}{336}$ £.

Reduce $\frac{5}{144}$ of a lb. troy, to the fraction of a dwt. Answer $\frac{25}{3}$ dwt.

*CASE.*

12.—To find the proper quantity or value of a fraction in money, weights, &c.

*RULE.*

Multiply the numerator of the given fraction, by the parts contained in the Integer to which it belongs, then divide that product by the denominator; and if any thing remains, reduce it to the next denomination less and divide again by the denominator; thus proceed to the least denomination, as in Compound Division, case 3.

*EXAMPLES.*

What is the value of $\frac{7}{9}$ of a ficca rupee.

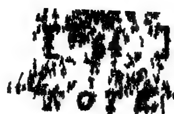
```
       7
      16
      --
   9)112
     ---
an.  12 .. 4
          12
          --
        9)48
          --
pa.  5 3/9 or 1/3.   Answer 12 an. 5 1/3 pa.
```

Required the value of $\frac{135}{480}$ of a pound sterling. Answer 5 s. 7 $\frac{1}{2}$ d.

What is the quantity of $\frac{7}{8}$ of a bazar mon. Answer 35 fars.

What is the value of $\frac{7}{10}$ of a star pagoda. Answer 31 fan. 40 c.

NOTE



The value of any fraction may be found in the same way.

## ADDITION OF VULGAR FRACTIONS.

### *RULE.*

1.—REDUCE the given fractions to a common denominator, by case 9, in Reduction.

2.—Add all the numerators together for a new numerator, under which, subscribe the common denominator. And if it be an improper fraction reduce it to its proper terms, by case 8 in Reduction, and you have the sum of all the fractions.

### *EXAMPLES.*

Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ together. $\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}=\frac{360}{720}+\frac{480}{720}+\frac{540}{720}+\frac{576}{720}+\frac{600}{720}=\frac{2556}{720}$ or $3\frac{11}{20}$ Answer.

| | | |
|---|---|---|
| $1\times3\times4\times5\times6$ . . | 360 | new numerators added together make $\frac{2556}{720}$, which |
| $2\times2\times4\times5\times6$ . . | 480 | |
| $3\times2\times3\times5\times6$ . . | 540 | reduced to its proper terms is $3\frac{11}{20}$. |
| $4\times2\times3\times4\times6$ . . | 576 | |
| $5\times2\times3\times4\times5$ . . | 600 | |
| $2\times3\times4\times5\times6$ . . | 720 | common denominator. |

Add $\frac{3}{7}$, $\frac{1}{4}$, $\frac{5}{6}$, together. Answer $\frac{254}{168}$ or $1\frac{43}{84}$.

Add $\frac{2}{3}$ of $\frac{4}{5}$, and $\frac{13}{15}$, together. Answer $\frac{21}{15}$ or $1\frac{2}{5}$.

### To add the mixed numbers.

### *RULE.*

Reduce the fractions to a common denominator and add them together, as before directed in the preceding case, and annex their sum to the sum of the Integers.

### *EXAMPLE.*

What is the sum of $\frac{3}{4}$ of $\frac{5}{9}$, and $2\frac{1}{2}$. First $\frac{3}{4}$ of $\frac{5}{9}$ is equal to $\frac{15}{36}$; and $2\frac{1}{2}$ is

equal

equal to $\frac{5}{2}$; these reduced to a common denominator are equal to [illegible], whose sum $\frac{210}{72}$ reduced to its proper terms is $2\frac{11}{12}$ Answer.

Add $7\frac{2}{3}$, $9\frac{4}{5}$, and $6\frac{7}{10}$, together. First $\frac{2}{3}+\frac{4}{5}+\frac{7}{10}$ is when reduced to a common denominator equal to $\frac{100}{150}+\frac{120}{150}+\frac{105}{150}$ whose sum is $\frac{325}{150}$ which reduced to its proper terms is $2\frac{1}{6}$. Then $7+9+6$ and $2\frac{1}{6}$ make $24\frac{1}{6}$ the sum required.

or thus.

| | | |
|---|---|---|
| $7\frac{2}{3}$ | equal to | $7\frac{100}{150}$ |
| $9\frac{4}{5}$ | . . . . . . | $9\frac{120}{150}$ |
| $6\frac{7}{10}$ | . . . . . . | $6\frac{105}{150}$ |
| | | $24\frac{25}{150}$ or $\frac{1}{6}$ Answer. |

Add $8\frac{1}{2}$, $9\frac{2}{3}$, $10\frac{3}{4}$, $11\frac{4}{5}$, and $12\frac{5}{6}$, into one sum. Answer $53\frac{11}{20}$.

When the given fractions are of several denominations.

*RULE.*

Reduce them to one denomination, by case 11 in Reduction, then add them together as before directed, or you may reduce them to proper quantities by case 12, and add as in Compound Addition.

*EXAMPLES.*

What is the sum of $\frac{201}{460}$ of a sicca rupee, and $\frac{1}{8}$ of an anna?

First $\frac{1}{8}$ of an anna, by case 11, is equal to $\frac{1}{128}$ of a rupee.

Then $\frac{201}{460}$ and $\frac{1}{128}$ of a rupee, reduced to a common denominator are equal to $\frac{25728}{58880}$ and $\frac{460}{58880}$, the sum whereof is $\frac{26188}{58880}$ or $\frac{6547}{14720}$ in its lowest terms, equivalent in value, by case 12, to 7 an. $1\frac{91}{230}$ pa. Answer.

or thus.

| | | an. | pa. |
|---|---|---|---|
| $\frac{201}{460}$ of a rupee by case 12, equal to 6 an. $11\frac{103}{115}$ pa. or | | 6 | $11\frac{206}{230}$ |
| $\frac{1}{128}$ ditto . . . . . . ditto . . . $1\frac{1}{2}$ pa or | | 0 | $1\frac{115}{230}$ |
| Answer. Annas | | 7 | $1\frac{91}{230}$ as before. |

What

What is the sum of $\frac{3}{5}$ of a pound, $\frac{2}{10}$ of a shilling, and $\frac{6}{8}$ of a penny.

Answer 12 s. $6\frac{3}{4}$ d. $\frac{960}{1920}$.

Add $\frac{201}{460}$ of a £. to $\frac{1}{8}$ of a shilling. Answer 8 s. $10\frac{3}{4}$ d. $\frac{1}{28}$.

Add $\frac{1}{2}$ of a mon, to $\frac{7}{8}$ of a far. Answer 20 fars, 14 ck.

---

## SUBTRACTION OF VULGAR FRACTIONS.

### *RULE.*

1.—PREPARE the fractions, as before directed in Addition.

2.—Subtract one numerator from the other, and their difference will be a new numerator, under which subscribe the common denominator; but when the lower fraction is greater than the upper, subtract the numerator of the lower fraction, from the denominator, and to that difference add the upper numerator, carrying one to the units place of the lower whole number, then proceed as in Integers.

### *EXAMPLES.*

From $\frac{4}{5}$ take $\frac{2}{5}$

4
2
—
2, the remainder is $\frac{2}{5}$.

| | | | |
|---|---|---|---|
| From | $389\frac{6}{8}$ | $555\frac{2}{4}$ | $47\frac{10}{15}$ |
| Take | $142\frac{2}{8}$ | $29\frac{3}{4}$ | $39\frac{14}{15}$ |
| Rem. | $247\frac{4}{8}$ | $525\frac{3}{4}$ | $7\frac{11}{15}$ |
| Proof. | $389\frac{6}{8}$ | $555\frac{2}{4}$ | $47\frac{10}{15}$ |

Take $9\frac{1}{3}$ from $12\frac{3}{4}$. First $12\frac{3}{4}$, by case 7, in reduction, is equal to $\frac{51}{4}$ and $9\frac{1}{3}$ to $\frac{28}{3}$; both which being reduced to a common denominator, by case 9, are equal to $\frac{153}{12}$ and $\frac{112}{12}$, the difference is $\frac{41}{12}$, which being reduced to its proper terms, by case 8, gives $3\frac{5}{12}$. Answer.

From

From $\frac{5}{8}$ of a sicca rupee, take $\frac{4}{6}$ of an anna.

First $\frac{4}{6}$ of an anna, is by case 11 in Reduction, equal to $\frac{4}{96}$ of a rupee;

Then $\frac{5}{8}$ and $\frac{4}{96}$ reduced to common denominator are equal to $\frac{480}{768}$ and $\frac{32}{768}$,

The difference is $\frac{448}{768}$ or $\frac{7}{12}$ in its lowest terms, equivalent in value to 9 an. 4 pa Answer.

or thus.

| | | r. | an. | pa. |
|---|---|---|---|---|
| $\frac{5}{8}$ of a sicca rupee is, by case 12, equal to | | 0 | 10 | 0 |
| $\frac{4}{6}$ of an anna . . . . . . . | ditto | 0 | 0 | 8 |
| Answer | | 0 | 9 | 4 as before. |

What is the difference between $\frac{5}{9}$ of a pound sterling, and $\frac{2}{3}$ of $\frac{3}{4}$ of a shilling. Ans. $\frac{1}{10}$ or 10s. 7 $\frac{1}{4}$ $\frac{1}{3}$ d.

---

## MULTIPLICATION OF VULGAR FRACTIONS.

*RULE.*

1.—PREPARE the fractions to be multiplied, by the rules of reduction, that is, reduce compound fractions to simple ones, by case 6; bring mixed numbers into improper fractions, by case 7; then reduce the fractions into their lowest terms, by case 5.

2.—Multiply the numerators into one another for a new numerator, and the denominators for a new denominator.

*NOTE.*

Multiplication of fractions decrease the value in the same proportion as whole numbers increase it. It is the nature of integers to increase, and of fractions to decrease, yet, the purpose of multiplication is equally answered in both cases, as will appear by the following:

*EXAMPLES.*

Multiply 4 annas by 4 annas, as the fraction of a rupee.

First 4 annas is $\frac{1}{4}$ of a rupee, therefore $\frac{1}{4}$ multiplied by $\frac{1}{4}$ is equal to $\frac{1}{16}$, or 1 anna, Answer.

Multiply

Multiply [illegible] by [illegible]. Answer $\frac{7}{22}$.

Multiply $12\frac{1}{2}$ by 6. Answer 75.

Multiply $17\frac{3}{5}$ by $\frac{7}{8}$. Answer $\frac{77}{5}$ or $15\frac{2}{5}$.

Multiply $2\frac{1}{4}$ by $\frac{1}{4}$ of $\frac{7}{8}$. Answer $\frac{231}{128}$ or $1\frac{103}{128}$.

*N O T E.*

It feems incongruous and contradictory to the definition of multiplication, that it decreafes the value of fractions, but if we confider that the more any integral is increafed, the farther is the higheft place removed from unity ; and the more any part of an integer is decreafed, the farther will its value alfo be removed from its relative unit.

Suppofe the firft example was propofed. and an anna to be the integer; then the work would have been $4 \times 4 = 16$ annas or one rupee ; which fhews that your product will alter in value, according as you alter your integer.

---

## DIVISION of VULGAR FRACTIONS.

*R U L E.*

PREPARE the fractions (as before directed) by the rules of reduction then multiply the denominator of the divifor by the numerator of the dividend, for a new numerator; and then the numerator of the divifor by the denominator of the dividend for a new denominator; or invert the divifor and proceed as in multiplication.

*E X A M P L E S.*

Divide $\frac{8}{117}$ by $\frac{4}{13}$.

$\frac{4}{13}) \frac{8}{117} (\frac{104}{468}$ or $\frac{2}{9}$ or $\frac{13}{4} \times \frac{8}{117} = \frac{104}{468}$ Anf.

Divide $\frac{2}{5}$ by 7. Anfwer $\frac{2}{35}$.

Divide $5\frac{1}{7}$ by $2\frac{3}{5}$. Anf. $\frac{190}{91}$ or $2\frac{8}{91}$.

Divide $\frac{36}{114}$ by $\frac{6}{19}$.

$\frac{19}{6} \times \frac{36}{114} = \frac{684}{684}$ or 1.

Divide 7 by $\frac{2}{5}$. Anfwer $\frac{35}{2}$ or $17\frac{1}{2}$

Divide $\frac{21}{37}$ by $5\frac{1}{17}$. Anfwer $\frac{231}{2.92}$.

Divide

Divide $\frac{3}{4}$ of a rupee, by $\frac{2}{3}$ of an anna. Answer [illegible] 16 rupees.

Divide $\frac{2}{3}$ of a shilling, by $\frac{3}{4}$ of a £ : Answer [illegible]d. [illegible]

*NOTE.*

If you divide by a proper fraction, the quotient is always a greater number than the dividend; contrary to whole numbers, and likewise contrary to the strict sense of the word division, which implies the lessening of a thing: Consequently, if the divisor be a proper fraction, Multiplication prevails; but Division prevails, if the divisor be an improper fraction, as is shewn in the last two examples.

---

## DECIMAL FRACTIONS.

IN decimal fractions, the figures of the numerator are only expressed, the denominator being omitted, because it is always (or understood to be) 1, with as many ciphers affixed, as there are places or figures in the numerator.

A decimal fraction, is distinguished from an Integer or whole number, by a point, dot, or comma, prefixed, called the SEPERATRIX; thus, .5 stands for $\frac{5}{10}$; .75 for $\frac{75}{100}$; .874 for $\frac{874}{1000}$; &c.

Ciphers placed to the right hand of a decimal fraction do not alter its value; for .5; .50; .500; or .5000, are each the same value, but ciphers on the left of a decimal fraction decreases its value in a ten fold proportion, thus:

| | | |
|---|---|---|
| 1. . . . . | unit or integer | |
| .1 . . | one tenth part of the Integer . . . . . called | primes |
| .01 . . | one hundredth part . . . . . . . . . . . . . | seconds |
| .001 . | one thousandth part . . . . . . . . . . . . | thirds |
| .0001. | one ten thousandth part . . . . . . . . . . | fourths |
| .00001 | one hundred thousandth part . . . . . . . . | fifths, &c. |

It therefore plainly appears, that as integers increase in a tenfold proportion towards the left, so decimal parts or fractions decrease by the same proportion to the right.

Vulgar fractions being the foundation of decimal fractions, the manner of reducing them to decimals is shewn in the following rule, by

by which means all those computations hitherto deemed so intricate, may be performed with the utmost ease, pleasure, and accura-

---

## REDUCTION OF DECIMALS.

*CASE.* 1.—TO reduce a vulgar fraction to a decimal.

*RULE.*—Annex ciphers to the numerator at pleasure and divide it by the denominator; the quotient will be the decimal fraction required.

Take notice what number of ciphers in the numerator you make use of, because you must point off the same number of places or figures in the quotient; but when it happens, that there be not a sufficient number of figures in the quotient, the defect must be supplied by prefixing ciphers on the left.

*NOTE.*—In all operations, if the result consist of several nines, reject them, and make the next superior place one more, thus: for 4. 699, write 4. 7; for 6. 999, write 7. &c.

*EXAMPLES.*

Reduce $\frac{3}{4}$ to a decimal.

Here, I affix two ciphers to the numerator 3, and dividing by the denominator, the quotient is 75; two ciphers having been annexed and used, to which therefore I prefix the seperatrix or decimal point. When there is no remainder as in this example, the decimal is complete and called a FINITE DECIMAL.

4)3.00
. 75

Reduce $\frac{1}{16}$ to a decimal.

Here, I annex four ciphers, but as the quotient gives only three places, that is, 625, I supply the defect by prefixing a cipher.

16)1.0000
.0625

Reduce $\frac{7}{3125}$ to a decimal.

Here, I have annexed five ciphers, but the quotient gives only three decimal places (224), therefore prefix two ciphers.

3125)7.00000(.00224
6250
7500
6250
12500
12500

Reduc

Reduce $\frac{1}{3}$ to a decimal.

Here, the remainder being ſtill the ſame, that is, 1; the ſame figure will be conſtantly repeated in the quotient, and the repeating figure is called a SINGLE REPETEND, and is denoted by a point above it, thus ; $.\dot{3}$; $\dot{3}$, ſo $\frac{4}{9} = .\dot{4}$; $\frac{5}{9} = .\dot{5}$ &c.

$3)1.00$
$.3\dot{3}$

Reduce $\frac{4}{15}$ to a decimal.

When a figure or a cipher, or figures come between the decimal point and the repeating figure, as in this example, the decimal is called a MIXED REPETEND, and the figure or figures ſo intervening, are called FINITE PARTS of ſuch decimal, which in this example is 2.

$15)4.00(.2\dot{6}$
30
———
100
90
———
10

Reduce $\frac{1}{11}$ to a decimal.

When the decimal conſiſts of two or more repeating figures, as $\dot{1}\dot{4}$, $\dot{1}4\dot{8}$, $.\dot{3}7\dot{3}$, or, as in this example, $.\dot{0}9\dot{0}9$, &c. it is called a PURE CIRCULATE, and is denoted by a dot above the firſt and laſt figure of the circle. When the decimal conſiſts of figures between the ſeparating point and the circulate it is called a MIXED CIRCULATE, as $17.17698\dot{4}$, and 17 are the finite parts.

$11)1.0000(.0909$ &c.
99
———
100
99
———
1

Reduce $\frac{35}{721}$ to a decimal.

Whatever number of ciphers you annex it will often happen, that there will ſtill be a remainder, as in this example, but if the quotient be extended to four or five places, it will be exact enough for buſineſs, but where great accuracy or nicety in calculation be required, it may be extended to any number of places, that may be thought neceſſary, and this decimal is called an INFINITE, becauſe it never ends, nor arrives at a repeater, and is uſually denoted by writing AD INFINITUM, as in the margin.

$721)35.000(.048$, &c. ad infinitum
2884
———
6160
5768
———
392

Reduce $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ to decimals. Anſwer .25; .5; .75.

Reduce $\frac{5}{24}$ to a decimal. Anſwer $.208\dot{3}$.

Reduce $\frac{5}{12}$ of $\frac{3}{4}$ to a decimal. Anſwer .3125.

Reduce $\frac{4}{7}$ to a decimal. Anſwer $.\dot{5}7142\dot{8}57$.

Reduce $\frac{2}{3}$ to a decimal. Anſwer $.\dot{6}$

Reduce $\frac{5}{48}$ to a decimal. Anſwer $.1041\dot{6}$

NOTE

***NOTE.***—.5 is equal to $\frac{1}{2}$ .25 to $\frac{1}{4}$ and .75 to $\frac{3}{4}$ of any thing.

***CASE* 2.**—To reduce money, weights, &c. into decimals.

***RULE.***—Reduce the given money, weights, &c. into the lowest denomination or name mentioned for a dividend, then reduce the Integer into the same denomination for a divisor, and the quotient will be the decimal required.

OR

Write the given denominations or parts, orderly under each other, the inferior or last parts uppermost, let these be dividends; against each part on the left hand, write the number thereof contained in one of its superior, let these be divisors; then beginning with the lowest denomination, with ciphers annexed. (making a dot between the ciphers and the figures) and divide, writing the quotient of each divisor, as decimal parts on the right hand of the dividend next below it, and let this mixed number be divided by its divisor, and so on, till all be finished, and the last quotient will be the decimal required.

***NOTE* 1.**—In reducing decimals, it is unnecessary to mind any ciphers on the right of the divisor, as ciphers must be annexed to the remainders to bring out the quotient.

2.—When in any division, the dividend is a repetend, or circulate, the division is carried on, not by annexing ciphers, but by that repetend or circulate.

*EXAMPLES.*

Reduce 15 an. 3 pice to the decimal of a rupee.

Here the given money 15 an 3 pi. reduced to the lowest denomination is 183 p. and the integer (one rupee), reduced to the same denomination is 192 p. which forms the vulgar fraction $\frac{183}{192}$, which being reduced, by the last case, gives the finite decimal in the margin.

```
192)183.000000(.953125 Answer
    ----------
       rem. 0
       ------
```

OR

Here, the least given parts are 3 p. which set down; the next are 15 an. which place underneath the 3 p. then annexing cipher, divide by 12 (pauy in an anna), and set the quotient .25 down on the right hand of the next dividend, (15 an.), and divide it, by 16 (an. in a rupee), the quotient (being the last) is the answer, as per margin.

```
12)3 00
   ----
16)15.250000
   ---------
    .953125 as before.
    -------
```

Reduce 30 sars, 10 ck. to the decimal of a mon.

1st WAY.

| | | |
|---|---|---|
| 30 sr. 10 ck. reduced is | | 490 ck. |
| 1 mon . . ditto | | 640 ck. |

then divide as in the last example, gives the decimal .765625 Answer.

2d WAY.

```
16) 10.000
    ----------
 40) 30.625000
    ----------
    .765625 Answer.
```

Reduce

Reduce 5 an. 4 pa. to the decimal of a rupee. Answer $\dot{3}$

Reduce 17 s. 6¾ d. to the decimal of a pound. Answer .878125

Reduce 6 fars, 7 ck. to the decimal of a mon. Answer .1609375

Reduce 25 fanams, 10 cash, to the decimal of a star pagoda. Answer 558$\dot{3}$

Reduce 3 qrs. 5 reas, to the decimal of a Bombay rupee. Answer 7625

Reduce 3 pauy, to the decimal of a sicca rupee. Answer .015625

Reduce 5 annas, to the decimal of a sicca rupee. Answer .3125

Reduce 11 dwts. to the decimal of a lb. troy. Answer .0458$\dot{3}$

Reduce 10 drams, to the decimal of a lb. avoirdupois. Answer .03906

Reduce 4 inches, to the decimal of a foot. Answer .$\dot{3}$

Reduce 3 qrs. 14 lb. to the decimal of a cwt. Answer .875

Decimal Tables are constructed by this rule; and they who think such tables contribute any thing to expedition, may easily construct them; but any decimal parts may be found more expeditiously, than picked out of a table, by one conversant in figuring, and with the further advantage, that by calculating them on all occasions, one gains a certain practice which renders it easy and familiar, at the same time that he avoids the errors which such tables (when printed) are liable to, and also the meanness of borrowing the abilities of another person.

*CASE* 3.—To find the value of a decimal fraction in money, &c.

*RULE*.—Multiply the given decimal by the number of parts contained in the next inferior denomination, pointing off so many places for decimals to the right hand as your decimal consists of, and those on the left will be integers, then multiply the remaining decimals, by the next inferior denomination, and point off for decimals as before; thus proceed until you have brought it into the least parts of an integer.

*EXAMPLES*.

What is the value of .953125 of a sicca rupee?

The given decimal consists of six places; multiply it by 16 (annas in a rupee), point off six places from the right to the left of the product, and the figures remaining on the left are annas (15); then multiply the remaining decimals by 12 (pauy in an anna) and point off, as before; the integer (one rupee) is then reduced into its least parts and the answer is 15 an. 3 p.

```
  .953125
       16
 ---------
15.250000
       12
 ---------
 3.000000
```

*NOTE*.—It is unnecessary to set down the ciphers on the right hand, because they are of no value.

If the given decimal terminates in a repetend, carry 1 for every 9 in the product of the first figure of the multiplicand.

What is the value of .3625 of a star pagoda. Answer 16 fan, .25 c.

Wha

What is the value of .984375 of a Bombay rupee. Anſwer 3 qrs. 93.75 r.

How much is .525675 of a bazar maun. Anſwer 21 ſars, 0.432 ck.

What is the value of .873125 of a pound ſterling. Anſwer 17 s. $6\frac{3}{4}$ d.

What is the value of .175 of a cwt. Anſwer 19 .6 lb.

What is the value of .00243 of a lb. troy? Anſwer 14 grains.

What is the value of .578 of a Madras candy. Anſwer 11 vis, 22 .4 pol.

*CASE* 4.—To reduce a decimal fraction, to its primitive vulgar fraction.

1.—When the given decimal is finite.

*RULE.*—Divide both numerator and denominator of the given decimal by their greateſt common meaſure (by caſe 4 and 5 in Reduction of vulgar fractions), and the quotient is the vulgar fraction required in its loweſt terms.

*EXAMPLES.*

Reduce .875. to a vulgar fraction in its loweſt terms.

thus $.875 = \frac{875}{1000} = \frac{7}{8}$ Anſwer.

$$.875)1000(1$$
$$875$$

greateſt com. mea. 125) 875(7
875
———
0

then, $125)\frac{875}{1000}(\frac{7}{8}$ Anſwer

Or, inſtead of dividing by the greateſt common meaſure, you may divide by 2, 5, 10 or any number that will divide both numerator and denominator without a remainder, continuing the operation until the fraction be reduced to its loweſt terms;

thus: $5)\frac{875}{1000}(5)\frac{175}{200}(5)\frac{35}{40}(\frac{7}{8}$ as before.

Reduce .765625, to a vulgar fraction in its loweſt terms. Anſwer [illegible]

Reduce .00224, to a vulgar fraction in its loweſt terms. Anſwer [illegible]

Reduce .0625, to a vulgar fraction in its loweſt terms. Anſwer $\frac{1}{16}$.

2.—When the given decimal is a pure repetend or a pure circulate.

*RULE.*—Make the repeating figure or figures of the circle, the numerator of the vulgar fraction; the denominator is 9 for the repeating figure

figure, or 9 for every figure in the circle, and then, if occasion require, reduce this fraction to its lowest terms.

*EXAMPLES.*

Reduce $.\dot{3}$; $.\dot{6}$; $.\dot{2}\dot{7}$; $.\dot{7}14\dot{2}$; to vulgar fractions.

thus $\frac{3}{9}$ or $\frac{1}{3}$; $\frac{6}{9}$ or $\frac{2}{3}$; $\frac{27}{99}$ or $\frac{3}{11}$; $\frac{7142}{9999}$.

3.—When the given decimal is a mixed repeater or a mixed circulate.

*RULE.*—From the mixed repeater, or the mixed circulate, subtract the finite part and the remainder is the numerator of the vulgar fraction; the denominator is 9 for every place in the circulate with as many ciphers annexed as there are places in the finite part.

*EXAMPLES.*

Reduce $.0\dot{3}$; $.1\dot{6}$; and $.08\dot{3}$, to vulgar fractions.

thus; $\frac{03}{90}$ or $\frac{1}{30}$; $\begin{array}{r}16\\1\\\hline\end{array}$ $\frac{15}{90}$ or $\frac{1}{6}$; $\begin{array}{r}08\dot{3}\\08\\\hline\end{array}$ $\frac{75}{900}$ or $\frac{1}{12}$.

Reduce $.041\dot{6}$; $.58\dot{3}$ and $.1\dot{1}5384\dot{6}$ to vulgar fractions.

$\begin{array}{r}041\\\hline\end{array}$ $\begin{array}{r}58\\\hline\end{array}$ $\begin{array}{r}1\\\hline\end{array}$

Answer $\frac{375}{9000}$; $\frac{525}{900}$; $\frac{1153845}{9999990}$ or $\frac{1}{24}$; $\frac{7}{12}$ and $\frac{3}{26}$.

In this manner may any mixed number consisting of an Integer with a repetend or circulate, be reduced to an improper vulgar fraction, but no ciphers are to be annexed to the denominator for the figures of the Integer.

*EXAMPLES.*

Reduce $8.\dot{3}$; $4.1\dot{6}$; and $65.\dot{2}9\dot{6}$ to an improper vulgar fraction.

$\begin{array}{r}8\\\hline\end{array}$ $\begin{array}{r}41\\\hline\end{array}$ $\begin{array}{r}65\\\hline\end{array}$

Answer $\frac{75}{9}$, $\frac{375}{90}$, $\frac{65231}{999}$, or $\frac{25}{3}=8\frac{1}{3}$; $\frac{25}{6}=4\frac{1}{6}$, and $65\frac{8}{27}$.

*NOTE.*—Infinite or approximate decimals being imperfect or incomplete, cannot be reduced back exactly to the vulgar fractions from whence they resulted; but if the remainder of the infinite decimal be affixed to it in the form of a vulgar fraction, the remainder being the numerator, and the divisor the denominator, you will have a mixed number, which you may reduce to an improper vulgar fraction; then to the denominator

annex

annex as many ciphers as there are places in the infinite decimal, and this fraction reduced to its lowest terms will be the vulgar fraction required.

Reduce .048 ad infinitum, the remainder being 392 and the divisor 721 (see case 1 ex. 7) to a vulgar fraction.

$.048\frac{392}{721}$
721
———
50
105
339
———
35000, the improper fraction is $\frac{35000}{721}$, then $\frac{35000}{721000}$ or $\frac{35}{721}$.

CASE 5.—To reduce dissimilar or unlike circulates to others that are similar and conterminous.

Similar or like circles are such as consist of an equal number of places, thus, [illegible], and $.0\dot{5}$ are similar circles, because they consist of two places each, but [illegible] .148 are unlike; because the former consists of two and the latter of three places.

Conterminous circles are such as begin and end at the same distance from the separatrix or decimal point, thus, .1538 and 3846, are conterminous, because they begin and end at the same place; and .0714, and 5321, are also conterminous, but .63 and .534 are not conterminous, because they have not the same number of places, for circles cannot be conterminous, unless they be similar also.

Unlike circulates or circles are reduced to similar ones by the following method.

RULE.—Find the least multiple of the numbers denoting the number of places in the given circles, and extend each of the given circles to as many places as there are units in the least multiple.

NOTE.—The least common multiple of several numbers is found thus: write the numbers in a line and divide them by 2, 3, or any other number which will measure two or three of them exactly, place the quotients with the numbers undivided below, and divide them continually, till their quotients be 1, then the product of all the divisors multiplied continually, is the least multiple required.

What is the multiple of 6, 4, 3, 8.

| | | | | |
|---|---|---|---|---|
| 4 | 6. | 4. | 3. | 8 |
| 2 | 6. | 1. | 3. | 2 |
| 3 | 3. | | 3. | 1 |
| | 1. | | 1. | |

Then 4×2×3=24 Answer.

EXAMPES.

*EXAMPLES.*

Reduce .63 and .148 to similar circles.

Thus, I extend the circles to six places, because 6 is the least multiple of 2 and 3, the number of places in the given circles. .63 ==. .148==.

Reduce .72 and .02439 to similar circles.

Here, I extend each of the circles to ten places, because 10 is the least multiple of 2 and 5, the number of places in the given circulate. .72 ==.7272 .02439==.0243

In a circle, any one of the circulating figures may be made the first of the circle; 7.592, may be expressed thus, 7.5925; or thus, 7.59259, without changing its consequently a pure circulate may put on the form of a mixed circulate, if one figures on the left be set aside for the finite part, thus, .72=.727; 7 being th part; also .571428=.5714285 7, and thus .35=.35353.

That the value is not changed may be thus demonstrated.

$$727 = \frac{720}{990} = \frac{72}{99} = 72$$

Hence two or more given circles may be made conterminous b following method:

*RULE*.—Set aside by a comma on the left, as many figures as there are places in the longest finite part, and then long the several circles to as many places as will make them lar.

*EXAMPLES.*

Make .5463 and .9148 conterminous.

Here, because 54 is the longest finite part consisting of two places, I set aside 91 in the other circulate, for a finite part and then I prolong both circles to six places which renders them similar. .5463 . . . 54,6 .9148 . . . 91,4

Make .714285714, .3571428, and .36 conterminous.

Here, because the first circulate, has a finite part of three places, I set off three figures in each of the other two, for finite parts, and then to render them similar, I extend the figures of the circles to six places.

| | |
|---|---|
| .714,285714 | .714,28 |
| .3571428 | .357,14 |
| .36 | .363,63 |

Diffi

| Dissimilar. | Made similar and conterminous. |
|---|---|
| 9.814 | 9.81,481481 |
| 1.5 | 1.50,000000 |
| 87.26 | 87.26,666666 |
| .083 | .083,333333 |
| 124.09 | 124.09,090909 |

Make, 3,.27, and .045 conterminous and similar.

Make. 321,. 8262, . 05 and . 0902 counterminous and similar.

Make. 5217, 3643, and 17 . 123 similar and counterminous.

*CASE* 6.—To find whether the decimal fraction, equal to a given vulgar fraction, be finite or infinite, and how many places the repetend or circulate will consist of.

*RULE* 1.—Reduce the given fraction to its least terms (by case 5 in reduction of vulgar fractions), and divide the denominator by 2, 5, or 10 as often as possible.

2. Divide 9999, &c. by the former result, 'till nothing remains and the number of nines used will shew the number of places in the circulate, which will begin after as many places of figures as there were 10's, 2's, or 5's divided by.

If the whole denominator vanishes in dividing by 2, 5 or 10, the decimal will be finite, and will consist of as many places as you perform divisions.

*EXAMPLES.*

Required to find whether the decimal equal to $\frac{210}{1120}$ be finite or infinite, and if infinite how many places that repetend will consist of.

First $\frac{210}{1120}=\frac{3}{16}$; then 2) 16 ( $^2$8 ( $^2$4 ( $^2$2 ( 1. Hence the decimal will be finite, and there being four divisions, the decimal will consist of four places, $\frac{210}{1120}$ = .1875.

Let $\frac{1}{11}$ be the fraction proposed.

11) 1.00 — .09 11) 99, — 9 having used two nines the circulate must therefore consist of two places thus. 09

Let $\frac{2}{7}$ be the fraction proposed.

Let

Let $\frac{13}{404}$ be the fraction proposed.

Let $\frac{1}{8544}$ be the fraction proposed.

*NOTE.*—In finite decimals, the denominator is always some aliquot part of the numerator of the vulgar fraction increased by annexed ciphers, and such decimals take their rise from vulgar fractions, whose denominator is 2 or 5 or some power of 2 or 5, or the product of some of their powers.

If the denominator of a vulgar fraction be neither 2 nor 5, nor any of their powers, nor product of their powers, such a denominator will not divide the numerator with annexed ciphers without a remainder infinitely.

POWERS OF 2 AND 5.

| | | | |
|---|---|---|---|
| $2^1$ = | 2 | $5^1$ = | 5 |
| $2^2$ = | 4 | | 25 |
| $2^3$ = | 8 | $5^3$ = | 125 |
| $2^4$ = | 16 | $5^4$ = | 625 |
| $2^5$ = | 32 | $5^5$ = | 3125 |
| $2^6$ = | 64 | $5^6$ = | 15625 |
| $2^7$ = | 128 | $5^7$ = | 78125 |
| $2^8$ = | 256 | $5^8$ = | 390625 |
| $2^9$ | | $5^9$ = | 1953125 |

## ADDITION OF DECIMALS.

*RULE.* PLACE the given decimals, so that the decimal points may stand directly under each other, and consequently, tenths under tenths, hundreds under hundreds, &c., then if the given decimals be all finite or infinite, add as in Integers, placing the decimal point directly under the column of points; then the figures on the left of the point are Integers, and those on the right are a decimal of the Integer, consisting of as many places as there are figures in the longest of the given decimals.

*EXAMPLES.*

What is the sum of .75; .895; .5; .625; and .725

Ciphers on the right hand of a decimal fraction do not alter its value, if therefore ciphers be annexed, so as to give each decimal an equal number of places, they will be reduced to a common denominator, as is seen in the margin.

| | |
|---|---|
| .75 | .750 |
| .895 | .895 |
| .5 | .500 |
| .625 | .625 |
| .725 | .725 |
| 3.495 | 3.495 |
| | 1.000 |

What

What is the ſum of .276; .39; .213; 72014.7; 417; and .5032.

| | |
|---:|---:|
| .276 | .2760 |
| .39 | .3900 |
| .213 | .2130 |
| 72014.7 | 72014.7000 |
| 417. | 417.0000 |
| .5032 | .5032 |
| 72433.0822 | 72433.$\frac{0822}{10000}$ |

What is the ſum of .0476; 21.476; .0067; .64; 17.6; and .20764.
Anſwer 39.97791.

What is the ſum of .427; 64.075; 27.6421; 10.8; .0074; 104.046842.
Anſwer 206.998342.

*CASE* 2.—To add decimals wherein there are ſingle repetends.

*RULE.*—Make every line end at the ſame place, filling up the vacancies with the repeating figures, then add as before; only for every nine in the right hand row carry 1; and the figure under that place will be a repetend; then carry 1 at every 10 as uſual.

*EXAMPLES.*

What is the ſum of 47.67$\dot{4}$; 4.02642; 32.$\dot{6}$; 6.1$\dot{4}$; and 27.064$\dot{6}$.

| | | |
|---:|:---:|---:|
| 47.67$\dot{4}$ | . . thus . . | 47.67444 |
| 4.02642 | | 4.02642 |
| 32.$\dot{6}$ | | 32.66666 |
| 6.1$\dot{4}$ | | 6.14444 |
| 27.064$\dot{6}$ | | 2 .06466 |
| | Anſwer | 117.5766$\dot{4}$ |

What is the ſum of 11.$\dot{4}$, 6.14274, 91.7$\dot{8}$, 37.67$\dot{1}$, and 146.4$\dot{7}$6742.
Anſwer 293.5239$\dot{1}$.

*CASE* 3.—When all or any of the given decimals are circulates.

*RULE.*—Make all the circles or circulates ſimilar and conterminous, by caſe 5 in reduction of decimals, then add up the left hand column of the circulates, and for every ten carry one to the right hand column, then proceed as in integers.

If

If repeaters be mixed with circulates, give the repeaters the form of circulates, by extending the repeating figure, 'till it becomes conterminous with the other circles.

*EXAMPLES.*

In order to find the carriage from the left hand column of the circles, I add the column next to it on the right; the sum of it is 22, then I carry 2 to the left column, the sum of which is 26, then I carry 2 to the right hand column, and the sum is 23, put down 3 and proceed as in addition of integers.

| | |
|---|---|
| 3.6 | 3.6666666 |
| 78.3476 | 78.3476476 |
| 735.3 | 735.3333333 |
| 375. | 375.0000000 |
| .27 | 0.2727272 |
| 187.4 | 187.4444444 |
| | 1380.0648193 |

If finite decimals are joined with the circulates, extend the finite parts of all the circulates to as many places, as there are figures in the longest finite decimal; therefore, in this example I extend the finite parts of the circulates to three places, because 875, the longest finite consists of three places.

| | |
|---|---|
| 18.7857142 | 18.785714285 |
| 25.81 | 25.818181818 |
| 14.5 | 14.500000000 |
| 29.75 | 29.750000000 |
| 35.875 | 35.875000000 |
| 24.013 | 24.013333333 |
| 32.7 | 32.777777777 |
| | Answer 181.520007215 |

If the decimals to be added are of different denominations, first reduce them into one denomination, and then add.

What is the sum of .725 of a pound sterling, and .625 of a shilling.
First .725 by case 3 in Reduction, is equal to 14.500 s.
then add .625 s.

s. 15.125
12

d. 1.500
4

f. 2.0 Answer 15 s. 1½ d.

OR

You may reduce the fraction of a shilling to that of a pound by case 11 in vulgar fractions, and then add.

If the decimals to be added run on to a great many places, it will be sufficient

ficient in most cases to use only five or six places, and observe to increase the figure at which you break off by an unit, if the rejected figure on the right exceed 5, and in adding such decimals, omit the right hand figure of the sum as uncertain, but take in the carriage.

| AT LARGE. | CONTRACTED. |
|---|---|
| 12.2352946 | 12.23529 |
| 8.15789325 | 8.15789 |
| 7.086968435 | 7.08697 |
| 6.32143482 | 6.32143 |
| 4.75 | 4.75 |
| 38.551591105 | 38.5515 |

Set 5391.357, 72.38, 187.21, 4.2965, 217.8496, 42.276, .523, and 58.30048 be added together.

Answer 5974.10371

Add 9.814, 1.5, 87.26, 0.83, and 124.09 together. Ans. 223.5057239.

What is the sum of .725 of a sicca rupee, and .625 of an anna.

Ans. .7640625 or 12 an. 2.7 pa.



## SUBTRACTION of DECIMALS.

*CASE* 1.—IF the given decimals be finite or infinite.

*RULE.*—Place the least under the greatest number, so that the decimals points may be exactly under each other, as directed in addition; then proceed as in subtraction of integers.

If the greatest and least numbers, have not the same number of places, imagine the void spaces to be filled up with ciphers.

*EXAMPLES.*

| | | | |
|---|---|---|---|
| From | 2464.21 | 48.525 | 54.6875 |
| Take | 327.07643 | 18.634375 | 36.875 |
| Remainder | 2137.13357 | 29.890625 | 17.8125 |
| Proof | 2464.21 | 48.525 | 54.6875 |

From 127.62, take 13.725 Answer 113.895
Take 6213.725 take 162.25 Answer 6051.475

CASE

*CASE* 2.—If one of the given decimals, be a repetend and the other a finite, or if both have ſingle repetends.

*RULE*.—Give the repetend one place more than the finite decimal, and in ſubtracting, the firſt figure on the right, you muſt borrow (if neceſſary) 9 inſtead of 10, then proceed as in integers.

If both numbers have repetends, give each an equal number of places, then ſubtract as before.

*EXAMPLES.*

| | | | |
|---|---|---|---|
| From | .7145833 | .525 | .9989583 |
| Take | .634375 | .3333 | .0291666 |
| Rem. | .0802083 | .1916 | .9697916 |

From 647 take .00746. Anſwer 646.99253

From 74.52 take 21.94648. Anſwer 52.575742

From 16.126 take 4.1942764. Anſwer 11.932390z6.

*CASE* 3—To ſubtract decimals that have circulates.

*RULE* 1.—If both numbers be circulates, make both circles conterminous and proceed as in integers, only if in the left hand column of the circulates, you foreſee that in ſubtracting, you muſt borrow, in this caſe add 1 to the right hand figure of the leaſt number and then ſubtract.

2.—If one of the given decimals be a circulate and the other a repeater, give the repeater the form of a conterminous circulate and then ſubtract as before.

3.—If one of the given decimals be a circulate and the other a finite decimal, extend the finite part of the circulate to as many places as there are figures in the finite decimal, and then ſubtract.

*EXAMPLES.*

RULE I.

| | | | |
|---|---|---|---|
| From | | thus .64,285714 | Obſerve that 8 cannot be taken |
| Take | .17857142 | .17,857142 | from 2, in the left hand column |
| Remainder | . . . . . . . . | 46,428571 | of the circulates, therefore add |

1 to the right hand (2) according to the rule.

RULE 2.

From .9285714 . . . . thus .9285714   Here, I cannot take 6 from 2 on
Take .6   .6666666   the left, therefore add 1 to the right (6), as before.

Remainder . . . . . . . . . . . .26.9047

RULE 3.

From .384165 thus .384,165   Here, I extend the finite part of the circulate to three places because the finite decimal 125 consists of three places.
Take .125   .125,

Remainder .259165

From 85.62, take 13.76432. Answer 71.86193
From 3.8564 take .0382. Answer 3.81824
From .75 take .07142857 Answer .67857142

# MULTIPLICATION OF DECIMALS.

*CASE* 1.—IF both factors are finite or infinite.

*RULE.*—Place your factors and multiply exactly as in Multiplication of Integers, then point off so many places of decimals from the right towards the left of the product, as are in both factors, and if the product has not so many places, supply that defect by prefixing ciphers.

*EXAMPLES.*

| Multiply .785 by .75. | Multiply 73. by 2.5. | Multiply .125 by .25. |
|---|---|---|
| .75 | 2.5 | .25 |
| 3925 | 365 | 625 |
| 5495 | 146 | 250 |
| Product .58875 | 182.5 | .03125 |

| Mult. .0375 by .05. | Mult. 85. by. 5. | Mult. .95 by 7. | Mult. 4.75 by 6. |
|---|---|---|---|
| .05 | .5 | 7 | 6 |
| .001875 | 42.5 | 6.65 | 28.50 |

Mult. 79.347 by 23.15 Answer 1836.88305.
Mult. .63478 by .8204 Answer .520773512.

Mult.

Mult. .385746 by .00464 Anſwer .00178986144.

To multiply by 10, 100, 1000, &c., move the decimal point ſo many places towards the right hand as there are ciphers in the multiplier, thus :

.4375×10 =4.375  .4375×1000 =437.5
.4375×100=43.75  .4375×.0000=4375.

*C A S E* 2.—To contract the operation ſo as to retain as many decimal places in the product as may be thought neceſſary.

*R U L E* 1.—Write the units place of the multiplier inverted under that place of the multiplicand, whoſe place you intend the product ſhall extend to, and diſpoſe of the reſt of the figures in the contrary order to what they are uſually placed in.

2.—In multiplying reject all the figures that are to the right hand of the multiplying digit, and ſet down the products, ſo that their right hand figures may fall in a ſtraight line below each other ; obſerving to increaſe the firſt figure of every line with what would ariſe, by carrying 1, from 5 to 15 ; 2. from 15 to 25 ; &c. &c. from the preceding figures when you begin to multiply, and the ſum is the product required.

*E X A M P L E S.*

Let it be required to multiply 27.14986 by 92.41035 and to retain only four decimal places in the product.

| CONTRACTED. | COMMON WAY. |
|---:|---:|
| 27.14986 | 27.14986 |
| 53014.29 | 92.41035 |
| 24434874 | 13\|574930 |
| 542997 | 81\|44958 |
| 108599 | 2714\|986 |
| 2715 | 108599\|44 |
| 81 | 542997\|2 |
| 14 | 24434874\| |
| 2508.9280 | 2508.9280\|650510 |

Multiply 245.378263 by 72.4385, reſerving five places of decimals in the product.
Anſwer 17774.8333[illegible]

Multiply .248264 by .725234, reſerving ſix figures ; five figures ; and four figures in the product reſpectively. Anſwer .180049 ; .18005 ; .1800.

Multiply 8634.875 by 843.7527 reſerving only the Integers in the product.
Anſwer 7285699.

CASE.

*CASE* 3.—If the multiplier be finite and the multiplicand repeat.

*RULE*.—In multiplying carry 1 for every nine in the product of the first or right hand figure, and before you add extend the repeating figures of the particular products, till their right hand figures stand directly under one another and in adding carry 1 for every nine in the sum of the right hand column.

*EXAMPLES.*

Multiply $6.4\dot{3}$ by 123.

```
   123
   ---
  193̇0  .... thus ......  1930
 128̇6  ..............  12866
 64̇3   ..............  64333
                     -------
             Product  791.30
```

Multiply $84.\dot{7}$ by 28000.

```
   28000.
  -------
   678̇2
  1695̇5
  -------
  2373777.7̇
```

If the multiplier has ciphers on the right as in this example; instead of annexing ciphers to the product, repeat its right hand figure, so many times as there are ciphers.

Turn both the terms into their equivalent vulgar fraction and find the product of those fractions as usual; then reduce the vulgar fraction expressing the product, to an equivalent decimal one. See cases 4 and 1 in Reduction of decimal fractions.

thus $6.4\dot{3}$
$\phantom{thus 6.}64$

$\frac{579}{90} \times \frac{123}{1} = \frac{71217}{90}$ or 791.3 as before ex. 1.

again $84.\dot{7}$
$\phantom{again 8}84$

$\frac{763}{9} \times \frac{28000}{1} = \frac{21364000}{9}$ or $2373777.\dot{7}$ as before

*CASE* 4.—If the multiplier be finite and the multiplicand a circulate.

RULE.

*R U L E.*—To the product of the right hand figure of the circulate, add the carriage from the left, then proceed as in Multiplication of Integers, but before you add the particular products, make them conterminous by case 5 in Reduction, then add as in Addition of circulates.

### *EXAMPLES.*

Multiply $.\dot{4}8\dot{1}$ by 7.

$$\begin{array}{r} .\dot{4}8\dot{1} \\ 7 \\ \hline 3.\dot{3}7\dot{0} \end{array}$$

I find the carriage from the left thus: 7 times 8 is 56, carry 5; then the left hand figure 7 times 4 is 28 and 5 make 33, carry 3 to the right and 7 times 1 is 7 and 3 make 10, set down 0 and go on as usual; the product circulates and its circle $.\dot{3}7\dot{0}$ is similiar to $.\dot{4}8\dot{1}$ the circle of the multiplicand.

or thus

$$\dot{4}8\dot{1} = \frac{481}{999} \times \frac{7}{1} = \frac{3367}{999} \text{ or } 3.\dot{3}7\dot{0} \text{ as before.}$$

Multiply $7.\dot{5}1\dot{8}$ by .5. Answer $3.7\dot{5}9\dot{2}$.

Multiply $7.\dot{5}1\dot{8}$ by .05 Answer $.37\dot{5}9\dot{2}$.

Multiply $7.\dot{5}1\dot{8}$ by .005. Answer $.037\dot{5}9\dot{2}$.

Multiply $4.7\dot{8}5714\dot{2}$ by 8.05. Answer 38.525.

Multiply $86.53\dot{5}714\dot{2}8$ by 58.75. Answer $5083.9732\dot{1}4285\dot{7}$

*N O T E.*—The circle of every particular product, will consist of the same number of places as there are in the circle of the multiplicand, and after having made the particular products conterminous; in adding take the carriage from the left hand column of the circulates, as in addition of circulates.

Multiply $.\dot{4}7\dot{6}$ by 354.

$$\begin{array}{rcr} \dot{4}7\dot{6} & & \\ 354 & & \\ \hline 1\dot{9}0\dot{5} & \text{. . thus . . .} & 19\dot{0}\dot{5} \\ 2\dot{3}8\dot{2} & \text{. . . . . . . .} & 2\dot{3}82\dot{3} \\ 1\dot{4}2\dot{9} & \text{. . . . . .} & 1429\dot{4}\dot{2} \\ \hline & \text{Product} & 168.\dot{6}7\dot{2} \end{array}$$

or thus.

$$\frac{476}{999} \times \frac{354}{1} = \frac{168504}{999} \text{ or } 168.\dot{6}7\dot{2}$$

If the multiplier has ciphers on the right; first, point the product in the same manner you would do, were the ciphers affixed; and then instead of ciphers, continue so many figures of the circle from the left to the right as serve to complete it.

Multiply

Multiply 3.961 by 489000.

3.961
  489000

31695 . . . thus . . . 31695
35657 , . . . . . . . 356576
15847 . . . . . . . . 1584784

Product 1973057.057

or thus.

$3.961$ or $\frac{3958}{999} \times \frac{489000}{1} = \frac{1971784000}{999}$ or $1973057.057$.

If the multiplier be infinite, reduce it to a vulgar fraction as directed in reduction of decimals, then multiply the given multiplicand by the numerator, and divide the product, by the denominator.

*C A S E* 5.—When a repeating multiplier, multiplies a finite multiplicand.

*R U L E.*—Reduce it to a vulgar fraction, as directed, in reduction of decimals case 4; then multiply the given multiplicand by the numerator and divide the product by the denominator, continuing the quotient if needful, till it arrives at a repeater.

*E X A M P L E S.*

Multiply 638.25 by .4.

Here the multiplier .4 is equal to $\frac{4}{9}$, therefore multiply by 4 and divide the product by 9. or thus, see last case.

$.4 = \frac{4}{9}$ 638.25

9)2553.

$638.25$ or $\frac{63825}{100} \times \frac{4}{9} = \frac{255300}{900}$ or $283.6$

Answer 283. 6

Multiply 872.35 by $.07 = \frac{07}{90}$ 9 X 10

Here I divide the product first by 9 which makes the quotient 678.494, then by 10 which is done by moving the decimal point one place to the left and gives 67.8494.

872. 35
$07 = \frac{07}{90}$ 07

90)610645

Answer 67.8494

Multiply

Multiply 87.34 by $2.6\dot{7}$ or $\frac{241}{90}$

The numerator of the vulgar fraction is found by subtracting the finite part, thus;

```
2.67
26
----
241
```

Then I divide first by 9 and then by 10 as in the last example; you may prove your work, according to the foregoing ex. 1.

```
     87.34
      241
   -------
      8734
     34936
    17468
   -------
90)2104894
   -------
Answer 233.8771
```

Multiply 7989 by $47.\dot{5}$ = 428

The numerator is found as befor:

```
475
 47

428 Numerator.
```

```
     7989
      428

    63912
   15978
  31956

9) 3419292
   -------
  379921.3
```

Multiply 680.748 by $3.21\dot{6}=\frac{2895}{900}$

```
       3403740
      6126732
     5445984
    1361496
    ----------
900) 1970765460
    ----------
Answer 2189.73940
```

Here, after dividing by 9 I divide by 100 which is done by moving the decimal point two places to the left.

Multiply 46.2762 by $.\dot{8}$  Answer 41.1344

Multiply 261.276 by $.\dot{4}\dot{7}$  Answer 124.83186

*NOTE.*—You may make your multiplicand the multiplier and work by case 3.

*CASE* 6.—When both factors repeat.

*RULE.*—Carry 1 for every nine in the product of the first figure.

RULE.

as in case 3, and when the product or dividend is exhausted in dividing by 9. continue the division by annexing to the remainders, the repeating figure of the dividend instead of ciphers and the quotient or product sought, comes out a mixed circulate.

*EXAMPLES.*

Multiply $6.8\dot{3}$ by $\dot{7} = \frac{7}{9}$.

9) 47.83

Answer $5.3\dot{1}4\dot{8}$

See cases 3 and 5, and you may prove your work by reducing both factors, to vulgar fractions, according to the foregoing case 3, thus:

Multiply $\dot{1}6.8$ by $3.\dot{8}\dot{4} = \frac{346}{90}$.

```
  34 6       38
  1013       3 46
  6755
 50666
 -----
90) 58435
 -----
 64.9283950617
```

```
6.83
 68
----
```

$\frac{615}{90}$ or $\frac{41}{6}$ in its least terms; then, $\frac{41}{6} \times \frac{7}{9} = \frac{287}{54}$ or $5.3\dot{1}4\dot{8}$

Multiply $5.\dot{6}$ by $2.\dot{3}$ Answer $13.\dot{2}$

Multiply $141.\dot{1}4$ by $8.4\dot{7}$ Answer $1196.\dot{5}891\dot{1}$

Multiply 24.6072 by .496 Answer 12.2

*CASE* 7.—When the repeating multiplier, multiplies a circulating multiplicand.

*EXAMPLES.*

Multiply $555.\dot{2}312\dot{1}95$ by $45.\dot{5} = \frac{410}{9}$

```
                  410       45
             ----------    ----
             555.2312195    410  see case 5.
            22209248780 4  ----
            -------------
        9)227644.799999
            ---------
           25293.86  Answer.
```

In multiplying take in the carriage from the left figure of the circle, as in case 4, and in dividing by 9, continue the division by annexing to the remainders the circulating figures of the dividend. After multiplying by 41, I again multiply by 10, which is done by placing the decimal point one place further to the right.

Multiply

Multiply 24.36 by .4 Anſwer 10.82.

Multiply 38.428571 by. 07. Anſwer 29.8.

*NOTE.*—You may prove your work, by reducing both terms to vulgar fractions. See caſe 3.

*CASE* 8.—When a circulate multiplies a finite multiplicand.

*EXAMPLES.*

Multiply 56.874 by 4.296 $=\frac{4292}{999}$

```
56.874      4.296
  4292          4
           ------
 113748     4292 = 4292/999
511866
113748
227496

999)244103.208(244.3475 Anſwer.
 1998

 4430
 3996
 ----
  4343
  3996

   3472
   2997
   ----
    4750
    3996
    ----
     7548
     6993
     ----
      5550
      4995

       555
       ---
```

*NOTE.*—You may prove your work as directed in the preceding caſe; or, make your multiplicand the multiplier and work by caſe 4.

Inſtead of dividing as above, it will be eaſier and ſhorter to annex as many ciphers to 1 as there are nines in the diviſor, for a new diviſor, and divide the dividend by it, and do the ſame with the quotient, till you get 0, then add up all the quotients together and the ſum will be the anſwer, thus:

1000)

```
1000) 244.103.208
         .244 103
              244
      -----------
        244.3475
```

In dividing by 10, 100, 1000, &c. you have only to move the decimal point as many places to the left, as there are ciphers in the divisor.

Multiply 825 by .36. Answer 300.

CASE 9.—When a circulate multiplies a repeating multiplicand.

*EXAMPLES.*

Multiply 8.02083 by .72 $= \frac{72}{99}$. See case 3.

```
        72
     -------
     1604166
    5614583 3
    ---------
99) 577.50( 5.83    Answer or thus;  5.7750
    495                               577
    ---                                 5
     825                             ------
     792             Answer          5.8333   as before.
     ---
     330
     297
     ---
      33
```

Multiply 18.783416 by 4.36 $= \frac{432}{99}$ Answer 81.964

Multiply 198.7052083 by .045 $= \frac{45}{990}$ Answer 9.0320549244

CASE 10.—When both factors circulate.

*EXAMPLES.*

Multiply .714285 by .36 $= \frac{36}{99}$.

Carry from the left, as in case 4, and divide as in case 8.

```
      .714285
           36
     --------
      4285714
     21428571
     --------
  99)25.714825
  ------------
Answer .25974025
```

Multiply

Multiply $3.2\dot{1}4285\dot{7}$ by $.6\dot{8}\dot{1} = \frac{675}{990}$. Answer $.21915\dot{5}8441\dot{5}$

Multiply $78.\dot{4}\dot{5}$ by $8.\dot{2}9\dot{6} = \frac{8288}{999}$. Answer $650.882\dot{1}5488\dot{2}$

## DIVISION OF DECIMALS.

IN divifion of decimals, the work is performed as in whole numbers; the only difficulty is, in valuing the quotient, which will be very eafy by obferving the following general rules.

There are two general rules for pointing the quotient, and extend to decimals of every fort, whether finite or infinite.

### I. GENERAL RULE.

The decimal places in the divifor and quotient together muft always be equal in number to thofe of the dividend.

The five following practical directions will make the application of this general rule perfectly eafy.

1.—When the divifor and dividend have an equal number of decimal places, the quotient is an Integer; as in the following example 2.

2.—When the decimal places of the dividend are more than thofe of the divifor; the number of decimal places in the quotient muft be equal to the excefs; as in ex. 1, 4, and 8.

3.—When the decimal places of the divifor are more than thofe of the dividend, annex ciphers to the dividend, fo as to make them equal and the quotient, by direction 1, will be integers; as in ex. 3, 5 and 7.

4.—When after divifion is finifhed, the quotient has not fo many figures, as by the general rule it ought to have decimal places, fupply that defect by prefixing ciphers; as in ex. 6.

5.—If after the dividend is exhaufted, there be a remainder, annex a cipher, or ciphers, to the remainder, and continue the Divifion till 0 remain, or till the quotient repeat or circulate, or till you have fuch a number of places as you think neceffary; as in ex. 9, 10, 11 and 12.

CASE.

*CASE* 1.—If the divisor and dividend are both finite, or infinite.

*RULE.*—Work exactly as in Integers, then point the quotient according to the foregoing directions.

*EXAMPLES.*

1. Divide .58875 by .75

In this example, a decimal divides a decimal, and because the dividend has five places and the divisor only two, I give three decimal places to the quotient, by direction 2.

```
.75).58875(.785 Answer
     525
     ---
      637
      600
      ---
       375
       375
       ---
         0
```

2. Divide 182.5 by 2.5

Here a mixed number divides a mixed number, and the divisor and dividend having an equal number of decimal places, the quotient is an integer, by direction 1.

```
2.5)182.5(73. Answer
    175
    ---
     75
```

*NOTE.*—You may prove your work by reducing both factors to their equivalent vulgar fraction, by case 4 in reduction of decimals, and then proceed as in division of vulgar fractions, thus:

$\frac{58875}{100000}$ or $\frac{471}{800}$ in its least terms.
$\frac{75}{100}$ or $\frac{3}{4}$ in its least terms.
then $\frac{471}{800} \div \frac{3}{4} = \frac{1884}{2400}$ or .785.

again $\frac{1825}{10}$ or $\frac{365}{2}$ in its least terms.
$\frac{25}{10}$ or $\frac{5}{2}$ in its least terms.
then $\frac{365}{2} \div \frac{5}{2} = \frac{730}{10}$ or 73..

3. Divide 475 by .85.

In this example, a decimal divides an integer and the dividend having no decimal place, I annex two ciphers to it, because there are two decimal places in the divisor, and the quotient is an integer, according to direction 3.

```
.85) 476.00( 560
     425
     ---
      510
      510
```

4. Divide .875 by 7.

Here, an integer divides a decimal, and becauſe the dividend has three decimal places, and the diviſor none, the quotient has three places, according to direction 2.

```
7) .875
   ----
   .125
```

5. Divide 12.75 by .375

A decimal divides a mixed number, in this example, and the diviſor having three decimal places and the dividend only two, I ſupply that defect by annexing a cipher, and the quotient is an integer, by direction 3.

```
.375) 12.750(34
      11 25
      -----
       1500
       1500
```

6. Divide .22875 by 2.5

Here a mixed number divides a decimal; and becauſe the dividend has four decimal places more than the diviſor; and the quotient after the diviſion is finiſhed having only three decimal places, I ſupply the defect by prefixing a cipher to it, according to direction 4.

```
2.5) .22875( .0915
      225
      ---
       37
      125
      125
```

7. Divide 180 by 3.75.

In this example a mixed number divides an integer; and the dividend having no decimal places, I ſupply that defect by annexing two ciphers, the number of decimal places in the diviſor and the quotient is an integer, according to direction 3.

```
3.75 )180.00( 48
      1500
      ----
      3000
      3000
      ----
         0
```

8. Divide 243.2 by 38.

Here, an integer divides a mixed number; and the diviſor having no decimal place, and the dividend only one, I give one decimal to the quotient, by direction 2.

```
38)243.2(6.4
   228
   ---
   152
   152
   ---
     0
```

9. Divide 29 by .8.

A decimal divides an integer in this example; and after the dividend is exhauſted, I annex a cipher to the remainder, and continue the diviſion until nothing remains, by direction 5.

```
.8)29.0
   ----
   36.25
   -----
```

10.

10. Divide .0024 by .018.

Here, a decimal divides a decimal; and after the dividend is exhausted, I annex a cipher to the remainder, and continue the division until I find the quotient repeats, by direction 5.

```
.018).0024(.133, &c.
       18
       --
        60
        54
        --
         60
         54
```

11. Divide 8. by 11.

Here, an integer divides an integer, and the dividend being less than the divisor, I annex a cipher to it, again after the dividend is exhausted I annex a cipher to the remainder, and continue the division, until I find the quotient circulates, by direction 5.

```
11)8.0

  .7272, &c.
```

12. Divide 76.75 by 3.25

A mixed number divides a mixed number, in this example; and after the dividend is exhausted, by annexing ciphers to the remainders, I continue the division till the quotient has three decimal places, and there is still a remainder; it might be carried further, but I limit it to three places, and five or six places is in most cases sufficiently accurate for business; according to direction 5.

```
3.25)76.75(23.615, &c.
     650

     1175
      975
     ----
     2000
     1950
     ----
       500
       325
       ---
       1750
       1625
```

2. GENERAL RULE.

The place of the first figure of the quotient is the same with the place of that figure in the dividend which stands over the units of the first product.

*EXAMPLES.*

Divide 32095 by 35.

In this example of integers 0 stands over 5, the units of the product of 9 times 35, and is in the place of hundreds, and therefore 9, the first figure of the quotient is likewise hundreds, and so the quotient is 917 integers.

```
35)32095(917
   315
   ---
     59
     35
     --
     245
     245
     ---
       0
```

Observe

Obſerve the following varieties in pointing the quotient.

| VAR. 1. | VAR. 2. | VAR. 3. |
|---|---|---|
| 35)3209.5(91.7. | 35)320.95(9.17 | 35.)32.095(.917 |
| 315 | 315 | 315 |
| 59 | 59 | 59 |
| 35 | 35 | 35 |
| 245 | 245 | 245 |
| 245 | 245 | 245 |
| 0 | 0 | 0 |

In all the above varieties, the figure 0 in the dividend ſtands over the units of the firſt product: in var. 1. the figure 0 is in the place of tens and accordingly the firſt figure in the quotient, 9, is tens: in var. 2, the figure 0 is in the place of units, and ſo 9 is units: in var. 3, the figure 0 is in the place of primes or tenth parts, and ſo 9 is nine tenths.

Divide 3.2095 by .0917. Anſwer 35
Divide 3.2095 by 35. Anſwer .0917
Divide .32095 by 35. Anſwer .00917
Divide .032095 by 35. Anſwer .000917
Divide 32095 by 3.5 Anſwer 9170
Divide 32095 by .35 Anſwer 91700
Divide 32095 by .035 Anſwer 917000
Divide 32095 by .0035 Anſwer 9170000
Divide 320.95 by 3.5 Anſwer 91.7
Divide 32.095 by 3.5 Anſwer 9.17
Divide .32095 by .35 Anſwer .917
Divide,. 2095 by 3.5 Anſwer .0917
Divide 314159265 by 579268 Anſwer 542.33837, &c.
Divide 579.268 by 31415 Anſwer .018, &c.
Divide 314159265 by 579.268 Anſwer 542338.3, &c.
Divide 3.14159265 by 579268 Anſwer .00000542, &c.
Divide 31.4159265 by 57.9268 Anſwer .542, &c.

In dividing by 10, 100, 1000, &c. you have only to move the decima point one place towards the left, for every cipher in the diviſor.

1C

| THUS | AND THUS. |
|---|---|
| 10)768(76.8 | 10)17.68(1.768 |
| 100)768(7.68 | 100)17.68(.1768 |
| 1000)768(.768 | 1000)17.68(.01768 |
| 10000)768(.0768 | 10000)17.68(.001768 |

When the divisor consists of many places of decimal parts, the work may be much abbreviated as follows:

*RULE.*—Write the product of the first quotient figure under the dividend; and from the situation of the units place, consider how many figures of the dividend must be retained to give the quotient the number of decimal places intended; cut off the other figures on the right, and also the figures corresponding to them on the right of the divisor; then subtract; esteem this and every following remainder a new dividual; and for each new dividual drop a figure on the right of the divisor; but in multiplying the quotient figures into the divisor, take in the carriage from the right hand, as in the following example.

Divide 95.432756463275 by 3.4637528 and limit the quotient to four decimal places.

```
3.46375 | 28)95.4327 | 56463275(27.5518
             69 2750 | 56
             -------
             26 1577
             24 2462
             -------
              1 9115
              1 7318
             -------
               1797
               1731
             -------
                 66
                 34
             -------
                 32
                 27
```

In this example, the units of the first product standing under the place of tens: the first figure of the quotient is tens; and hence it is easy to foresee, that six figures of the dividend retained will give four decimal places to the quotient; and accordingly I cut off all the other figures on the right of the dividend, I cut off likewise from the divisor two figures that correspond with them. At every new dividual I drop or omit a figure on the right of the divisor, and mark the figure so dropped by setting a point under it; and in multiplying the quotient figure 7 into the divisor, I say 7 times 7 is 49 and 3 I carry from the right make 52; so I set down 2 and carry 5. The same method is observed in multiplying every other quotient figure into the divisor.

I shall conclude division of finite decimals with two very useful problems, by which you may prove your work in multiplication and division; and work any case of division by multiplication; and also, any case of multiplication by division.

PROB. 1.

From a given multiplier to find a divifor, that gives a quotient equal to the product.

*R U L E.*—Divide an unit with ciphers annexed by the given multiplier and the quotient will be the divifor fought.

*E X A M P L E.*

What divifor will give a quotient equal to the product of any number multiplied by 125. for inftance, let the given number to be multiplied be 7315.

Given multiplier 125)1.000(.008 divifor fought.
then .008)7315.000(914375 quotient.

```
         7315
          125
        -----
        36575
        87780
        -----
product 914375
```

PROB. 2.

From a given divifor to find a multiplier that gives a product equal to the quotient.

*R U L E.*—Divide an unit with ciphers annexed, by the given divifor, and the quotient will be the multiplier fought.

*E X A M P L E.*

What multiplier will give a product equal to the quotient arifing from tht fame number divided by .008. Let 785 be the number to be divided.

∴ divifor .008)1.000(125 multiplier fought.

o

```
on 785              .008)785.00
   125                   -------
   ----                   98125 quotient.
   3925                   -----
  9420
  -----
  98125 product.
```

*C A S E* 2.—When a finite divifor divides a repeating dividend.

*E X A M P L E S.*

Divide $78.8\dot{3}$ by 12.5.

Work as in integers, but in continuing the divifion, inftead of annexing ciphers to the remainder, annex the repeating figure of the dividend.

Prove your work by cafes 3 and 4 in multiplication.

```
12.5)78.83(6.3
     750
     ---
      383
      375
      ---
       833
       750
       ---
        83
```

Divide

Divide 4.19662 by 37. Answer 11.342

Divide 56.1 by 30. Answer 1,8703

C A S E 3.—When a finite divisor, divides a circulating dividend.

*E X A M P L E S.*

Divide 1.17 by 25.

```
25)1.17(.0468
   100
   ---
    171
    150
    ---
     217
     200
     ---
     .17
```

Instead of annexing ciphers to the remainder, annex the circulating figures of the dividend.

Prove your work cases 3. 4 in multiplication.

Divide 3.7592 by 5. Answer .7518518.

Divide 25.0714285 by 6.5. Answer 3.857142S.

C A S E 4.—When a repeating divisor, divides a finite dividend.

*R U L E.*—Reduce the divisor to a vulgar fraction. (by case 4 in reduction of decimals) then multiply the given dividend by the denominator and divide the product by the numerator.

OR

Place the dividend under itself, but removed one place toward the the right hand which subtract and the remainder will be a new dividend: which divide by the divisor in the same manner as if it was a terminate or finite number; if the divisor consists of a repeater only.

*E X A M P L E S.*

Divide 23.5 by .4 $=\frac{4}{9}$

```
      9
   ----
  4)211.5
  -------
    52.875 Answer.
```

OR THUS

```
   235
    235
   ----
  4)2115
   ----
    52.875 as before.
```

Divide 759.011552 by 2

```
        90        214

214)68311.040580(319.21047
```

When your multiplier is 9 or many nines, for each figure of the multiplier annex a cipher to the multiplicand and from that number subtract the multiplicand, the remainder is the product. See. Case 6 following.

The numerator of the vulgar fraction is found by subtracting the finite part.

Divide

Divide 758.816 by 6.83. Anſwer 111.04624390.
Divide 8567.28 by 4.86. Anſwer 1760.4.

*CASE* 5.—When a repeating figure divides a repeating dividend.

*RULE*.—Proceed as in the laſt caſe; obſerving only to carry at 9 from the product of the firſt figure.

*EXAMPLES.*

Divide 43.26 by .3 = 3/9

```
   9
 ------
3)389.40
 ------
  129.8 Anſwer.
 ------
OR THUS
 432.66
  43.26
 ------
3)389.40
 ------
  129.8
 ------
```

Divide 21604.3 by 7.83 = 705/90

```
783)216043.33
 78 216043.3

705) 1944390.0(2758
```

Divide 25293.86 by 45.5. Anſwer 555.2312195.
Divide 56.034757 by 4.2. Anſwer 13.27159.

*CASE* 6.—When a repeating diviſor, divides a circulate.

*RULE*.—Proceed as in the laſt caſe; only take carriage from the product of the left hand figure of the circle.

*EXAMPLES.*

Divide 92.518 by .4 = 4/9

```
925.18 or thus 925185
     9          92518

4)832.6        4)832666
 ------         ------
 208.16 Anſwer  208.16
```

Divide 363.5740 by 48.3

```
483)3635.7407
 48  363.5740
 --  --------
435)3272.1666(7.52
    ---------
            2
            -
```

Divide 93.0073170 by 2.47. Anſwer 37.53658.

*CASE* 7.—When a circulate divides, a finite dividend.

EXAMPLES.

EXAMPLES.

Divide 9 by $.\dot{4}\dot{5} = \frac{45}{99}$

```
  99   or thus 900
 ----
45)891          9
   ----       ----
   19.8    45)891
   ----       ----
              19.8
```

Divide 81.964 by $4.\dot{3}\dot{6} = \frac{432}{99}$

```
 436)8196.400
   4   81.964
 ---  --------
 432)8114.436(18.783416
     --------
     Rem. 288
```

When the multiplier consists of 9 or many nines; first multiply the given dividend by 10 for 9; by 100 for 99; by 1000 for 999; &c. which is done by moving the decimal point, as many places to the right as there are ciphers in the multiplier, and from that product subtract the given dividend: if the dividend consists of an integer only, then annex to it as many ciphers, as there are nines, and then subtract as before; the remainder is the product sought.

When there are ciphers annexed to the nines in the multiplier, as 90, 990, 9900, &c.; first, multiply by nines only as before, and that product by 10, 100, &c. according to the number of ciphers, then proceed as before.

Divide 72 by $.0\dot{1}4\dot{8} = \frac{148}{9990}$. Answer 4860.

*CASE* 8.—When a circulate divides a repeating dividend.

*EXAMPLES.*

Divide $5.8\dot{3}$ by $.\dot{7}\dot{2} = \frac{72}{99}$

```
   583.33
     5.83
  -------
72)577.50)8.02083
  -------
      24
```

Divide $25.38\dot{6}$ by $19.39 = \frac{1920}{99}$

```
 19.39)2538.666
    19   25.386
 1920)2513.280(1.309
```

Divide $25293.8\dot{6}$ by $555.\dot{2}312\dot{1}95. = \frac{5552256672}{9999900}$ Answer $45.\dot{5}$.

*CASE* 9.—When a circulate divides a circulate.

*RULE.*—In dividing, when the dividend has a repeating figure r circulate; annex them instead of ciphers, to the remainders.

EXAMPLES.

*EXAMPLES.*

Divide .962 by .18 = $\frac{18}{99}$

96.296
.962

18)95.333(5.296 Ans.

Rem. 5

Divide 534.126 by 4.36 = $\frac{432}{99}$

436)53412.612
4 534.126

432) 52878486(122.40390

Rem. 16

Divide 340.90 by 53.571428 = $\frac{53571375}{999996}$ Anfwer 6.36.

## RULE OF THREE DIRECT.

TEACHETH, by having three numbers given, to find a fourth, in the fame proportion to the third, as the fecond is to the firft; or as the firft is to the fecond, fo is the third to the fourth; for which reafon it is called the the RULE OF PROPORTION; as it is called the RULE OF THREE from its having three numbers given: and becaufe of its excellent ufe in Arithmetic, it is often called the GOLDEN RULE.

To perform which, obferve with great attention the following

### *RULES.*

1. –Place that number or term, which is of the fame kind with the number fought, in the middle; the two remaining numbers or terms are always of the fame kind and are called EXTREMES, and the middle is called the MIDDLE TERM.

2.—Confider from the nature of the queftion, whether the fourth term or anfwer fought, muft be greater or lefs than the middle term; and if the anfwer muft be greater, the leaft extreme muft be placed on the left hand and the other on the right: but if the anfwer muft be lefs, then place the greateft extreme on the left and the other on the right of the middle term. Then multiply the fecond and third terms together, and divide their product by the firft; and the quotient gives the anfwer; which is always of the fame name or kind as the middle term.

*PROOF.*—Multiply the fourth term or anfwer, by the firft term; then multiply the fecond and third terms together, and if their products are equal, your work is right.

In

## IN VULGAR FRACTIONS.

1.—State your queſtion as before, obſerving that the extremes muſt be of the ſame denomination.

2.—Reduce mixed numbers and integers into improper fractions, and compound fractions to ſimple ones, by caſes 2 and 7 in reduction

3.—Then multiply the numerator of the firſt term, into the denominators of the ſecond and third, for the denominator of the anſwer; and multiply the denominator of the firſt term, into the numerators of the ſecond and third for the numerator of the anſwer, which being reduced to its proper value, gives the required anſwer.

---

## IN DECIMAL FRACTIONS.

Reduce the fractional parts into decimals of the higheſt name mentioned; then proceed as before.

### EXAMPLES.

If 4 yards of cloth coſt 12 ſicca rupees what will 6 yards coſt at that rate?

```
If 4 : 12 : : 6
        6
        —
      4)72
        —
  Ans. 18 ſiicca rupees
        —
```

In this example, the kind of the number ſought is rupees, therefore I place the given number 12 rupees, in the middle and the two remaining terms are extremes of the ſame kind; that is both yards. Now, it is eaſy to perceive that the anſwer muſt be greater than the middle term; for 6 yards will evidently coſt more than 4 yards at the ſame price, therefore the leaſt extreme is placed on the left hand, and the greateſt on the right of the middle term, and after multiplying the ſecond and third terms together, I divide their product by the firſt term, and the quotient 18 is the anſwer, and of the ſame name with the middle term, that is, 18 rupees.

2.—If 7 mons of rice coſt 21 rupees, how much will 5 mons coſt at that rate?

```
If 7 : 21 : : 5
        5
        —
     7)105
        —
  Ans. 15 rupees.
        —
```

Here the number ſought is the price of 5 mons, and the kind rupees, and the given term of the ſame is 21 rupees, whic· place in the middle, then it is obvious that the anſwer muſt be leſs than the middle term for 5 mons will coſt leſs than 7 mons at the ſame price, and therefore I place the greateſt extreme 7 on the left hand and the other extreme 5 on the right, and having multiplied and divided, as in the laſt example, the quotient is the anſwer of the ſame name with the middle term, that is, 15 rupees.

3.—If 13 yards of muslin cost 21 sicca rupees, what will 27 yards cost at that rate?

When there happens to be a remainder, as in this example, it may be reduced to the next inferior denomination, and the operation continued, as in the margin; see case 3 in compound division, or by decimals, thus;

```
13)567(43.6154
          16
      ------
  an. 9.8464
          12
      ------
pa. 10.15 &c.  Ans. 43 r. 9 a. 10 pa.
```

```
If 13 : 21 :: 27
        27
        --
   13)567(43 r. 9 an. 10 pa.
      ---
   Rem. 8
       16
       --
   13)128(9 annas
      117
      ---
  Rem. 11
       12
       --
   13)132(10 pauys.
      130
      ---
        2
```

4.—If 14 lb. of tobacco, cost 27 annas, what will 478 lb. cost, at that rate?

Here the middle term being annas, the first part of quotient is also annas, which I divide by 16 and so reduce it to rupees; and proceed with the remainder as in the preceding example.

```
If 14 : 27 :: 478
               27
              ---
     14)12906(16)921 annas.
        -----    ---
     rem. 12     57 r. 9 a. 10 p.
          12
          --
     14)144(10 pauys.
        140
        ---
          4
```

5.—If 15 ounces of silver be worth 3 £. 15 s. what are 86 oz. worth at that rate?

When the middle term is a compound number, as in this example, reduce it to the lowest name mentioned and the answer will be of the same name, that is, shillings; so I divide by 20 and reduce it to pounds.

```
If 15 : 3  15  0 :: 86
        20
        --
        75
        86
        --
  15)6450(20)430 shillings.
     ----    ---
        0    £. 21 10 0 Answer.
```

6.—

If 1 mon 15 fars of tobacco, cost 20 fa. rs. 10 an., what will 5 fars cost at that rate?

If your first and third terms consist of divers denominations, reduce them to the lowest name mentioned, for in the operation both extremes must be of the same name.

```
   M.  SR.   R.  A.        SAR.
If 1   15 : 20   10  : :  5
   40        16
   --        --
   55 fr.   330 an.
              5
            ---
     55)1650(16)30
        165    --
        ---  R. 1  14  0. Answer.
          0
          -
```

BY VULGAR FRACTIONS.

M. fr. R. An. fr.

1 15 is equal to $\frac{55}{40}$ or $\frac{11}{8}$; 20 10 equal to $\frac{330}{16}$ or $\frac{165}{8}$; 5 equal to $\frac{5}{40}$ or $\frac{1}{8}$

R. An.

then If $\frac{11}{8} : \frac{165}{8} :: \frac{1}{8} = \frac{1320}{704}$ or $1\frac{7}{8} = 1 \quad 14.$ thus, $\frac{8 \times 165 \times 1 = 1320}{11 \times 8 \times 8 = 704}$

BY DECIMALS.

M. fr. R. an. fr.

1 15 is equal to 1.375; 20 10 is equal to 20.625; and 5 is equal to .125.

```
then If 1.375 : 20.625 : : .125
                .125 R.     R. an.
               ------
   1.375)2578.125(1.875 or 1 14 0 Answer
         --------
               0 . 16
                -----
            an. 14.000
                ---
```

7.—If 3 cwt. 1 qr. 14 lb. of raisins, cost 10 lb. 2 s. 6 d.; what will 6 cwt. 3 qrs. cost at that rate?

Here, all the numbers are compound, and the two extremes are both reduced to lbs.; that being the lowest name mentioned.

The middle term for the same reason is reduced to pence, and accordingly the quotient is pence, which reduce to shillings, then to pounds.

```
If 3  1  14    :    10  2  6  ::   6  3  0
   4                20              4
   ---              ---            ---
   13               202             27
   28               12              28
   ---              ---            ---
   108              2430 d.        756 lb.
   27               756
   ---              ---
   378 lb.          1458
                   1215
                  1701
                  ----
          378)1837080(12) 4860
              -------     ----
                    0    20)405
                            ---
                      £. 20  5  0  Answer.
```

BY VULGAR FRACTIONS.

cwt. qr. lb. — £. s. d. — cwt. qrs.

3 1 14 $=\frac{27}{8}$; 10 2 6 $=\frac{81}{8}$; and 6 3 $=\frac{27}{4}$

Then, if $\frac{27}{8} : \frac{81}{8} :: \frac{27}{4} = \frac{17496}{864}$ or $20\frac{1}{4} = 20$ £. 5 s. thus $8\times81\times27=17496$
$27\times8\times4=864$.

BY DECIMALS.

cwt. qr. lb. — £. s. d. — cwt. qr.

3 1 14=3.375; 10 2 6=10.125; 6 3=6.75

```
                     6.75
                     ---- £.
3.375)68.34375(20.25=20 £. 5 s. Answer.
      ---------
             6
```

I advise the learner to work all the following questions by each method, because it will enable him to judge of the method best adapted to compute the questions in the subsequent rules. I presume the superior excellency of decimal arithmetic as the easiest and most accurate, as well as the most expeditious in most cases, will be obvious; and as dispatch next to accuracy, is the principal object in computations, I recommend to his consideration the following directions to abreviate or shorten his work; they are so very plain and easy, that a little practice will render them familiar.

IN COMMON ARITHMETIC.

1.—Divide the third term by the first; multiply that quotient by the second, and their product will be the answer.

2.—

2.—Divide the second term by the first, multiply that quotient by the third, and their product will be the answer.

3.—Divide the first term by the second, and divide the third term by that quotient, which will give the answer.

4.—Divide the first term by the third; the second by that quotient, and the last quotient will be the answer.

OR

Divide the first and second terms, or first and third terms, of your statement; as you perceive best adapted to shorten your work, by their greatest common measure (see case 4 in reduction of vulgar fractions); then proceed as usual.

BY DECIMALS.

You may contract your work by a greater variety of methods, in decimals, than the foregoing, because you can divide any number by a greater number, which will be shewn in the subsequent example 4.

*NOTE.*—Although the progress of the Learner may be here a little retarded by attention to those methods of abridging his operations; yet the facility derived from it will (in his future progress) amply compensate it.

*EXAMPLES.*

1.—If 4 yards of cloth cost 30 sa. r. 5 an. 3 pa., what must I pay for 28 yards at that rate?

Here, I place the first and third terms in the form of a fraction, thus, $\frac{4}{28}$, which divided by the least number or greatest common measure gives $\frac{1}{7}$.

See Dir. 1.

$4)\frac{4}{28}=(\frac{1}{7}$

| | yds: | | fa. r. | an. | pa. | | yds. |
|---|---|---|---|---|---|---|---|
| stated thus, as | 4 | : | 30 | 5 | 3 | :: | 28 |
| contracted | 1 | : | 30 | 5 | 3 | :: | 7 |
| | | | | | 7 | | |
| Sa. Rs. | | | 212 | 4 | 9 | Answer. | |

2.—If 3 chests of tea, each 3 cwt. cost £. 11 13, what must I give for 72 cwt. of the same?

$9)\frac{9}{72}=(\frac{1}{8}$. See dir. 1.

First $3\times3=9$ cwt. in the three chests

| | cwt. | | £. | s. | d. | | cwt. |
|---|---|---|---|---|---|---|---|
| stated thus, as | 9 | : | 11 | 13 | 0 | :: | 72 |
| contracted | 1 | : | 11 | 13 | 0 | :: | 8 |
| | | | | | 8 | | |
| £. | | | 93 | 4 | 0 | Answer. | |

3.—

3.—Suppose I give 78 sicca rupees, for 26 sars of raisins, what must be given for 156 sars of the same?

26) $\frac{26}{78} = \left(\frac{1}{3}\right.$. See dir. 2.

| | sr. | | sa. r. | | sr. |
|---|---|---|---|---|---|
| stated thus, as | 26 | : | 78 | :: | 156 |
| contracted . . . | 1 | : | 3 | :: | 156 |
| | | | | | 3 |
| | | | | Sa. Rs. | 468 |

4.—If 55 sars of tobacco cost 20 sa. r. 10 an.; what will 5 sars cost at that rate?

Here 5) $\frac{55}{5} = \left(\frac{11}{1}\right.$ by dir. 4.
See, foregoing ex. 6.

| | sr. | | sa. r. | an. | pa. | | |
|---|---|---|---|---|---|---|---|
| stated thus, as | 55 | : | 20 | 10 | 0 | :: | 5 |
| contracted . . | 11 | :) | 20 | 10 | 0 | :: | 1 |
| | Sa. Rs. | | 1 | 14 | 0 | | Answer. |

BY DECIMALS.

sars. mon. sars. mon.
55=1.375 5=.125

| | | | mon. | | sa. r. | | mon. | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Stated thus, as | 1.375 | : | 20.625 | :: | .125 . . | : | 1.875 |
| 1.375) | $\frac{.125}{1.375} = \frac{.0\dot{9}}{1}$ . . . | contracted . . | 1. . . . | : | 20.625 | :: | .$\dot{0}\dot{9}$ . . | : | 1.875 |
| .125) | $\frac{.125}{1.375} = \frac{1}{11}$ . . . | or thus . . . | 11. . . | : | 20.625 | :: | 1. . . | : | 1.875 |
| 20.625) | $\frac{1.375}{20.625} = \frac{.0\dot{6}}{1}$ . . . | or thus . . . | .0$\dot{6}$ | : | 1 . . | :: | 125 . | : | 1.875 |
| 1.375) | $\frac{1.375}{20.625} = \frac{1}{15}$ . . . | or thus . . . | 1 . . | : | 15 . . | :: | 125 . | : | 1.875 |
| | | | | | | | 15 | | |

See, foregoing ex. 6. Answer. Sa. Rs. 1.875

or sa. rs. 1 14 0

There are some questions where compound multiplication and division, may be very conveniently applied.

*EXAMPLES.*

If 35 pipes of Madeira Wine cost 410 sa. r. 15 an., what must I pay for 15 pipes at that rate?

pipes fa. r. an. pa. pipes

As 35 : 410 15 0 : : 15

3

1232 13 0 $3 \times 5 = 15$

5 $5 \times 7 = 35$

5)6164 1 0

7)1232 13 0

Sa. Rs. 176 1 $10\frac{2}{7}$ Anfwer.

or thus

As 7 : 410 15 0 : : 3

$5)\frac{35}{15} = \frac{7}{3}$

3

7) 1232 13 0

Sa. Rs. 176 1 $10\frac{2}{7}$ Anf.

If 8 cubits of cloth, coft 1 r. 8 an.; what will 59 cubits coft at that rate? Anf. 11 r. 1 an.

What muft I pay for 72 mons of rice, 9 mons of which coft 9 fa. r. 5 an.? Anf. 74 fa. r. 8 an.

How many cubits of cloth may be bought for 11 fa. r. 1 an., when 8 cubits coft 1 fa. r. 8 an.? Anf. 59 cubits.

What will 9 mons of rice coft, at the rate of 74 fa. r. 8 an. for 72 mons? Anf. 9 fa. r. 5 an.

If 7 mons, 10 fars of fugar, coft 56 fa. r. 4 an. 6 pa.; what will be the price of 43 m. 6 fr. 3 ck. at the fame rate? Anf. 335 fa. r., 0 an., 1.3176 pa.

What quantity of fugar may be bought for 335 fa. r. 0 an. 1.3176 pa. at the rate of 7 mons 10 fars for 56 fa. r. 4 an. 6 pa.? Anf. 43 m. 6 fr. 3 ck.

How many pieces of chintz may be bought for 500 fa. r., whereof 9 pieces coft 9 fa. r. 7 an. 6 pa.? Anf. $475\frac{25}{101}$ pieces.

What muft be paid for 26 bags of pepper at the rate of 44 fa. r. 6 an. for 7 bags? Anf. 164 fa. r. 13 an. $1\frac{5}{7}$ pa.

How many yards of broad cloth may be bought for 700 fa. r. 10 an.; 72 yards of which coft 45 fa. r. 9 an.? Anf. 1106 yards 3 qrs. $0\frac{180}{729}$ nails.

What quantity of fugar may be bought for 260 fa. r. 10 an. when 43 mons 20 fars, coft 300 fa. r. 6 an.? Anf. 37 m. 29 fr. $11\frac{3870}{4806}$ ck.

A perfon failing in trade, owes in all 55000 fa. r., and has property amounting to 2532 fa. r. 14 an. 6 pa., fuppofing that fum to be divided among his creditors, what will they get per rupee? Anf. $8\frac{46318}{55000}$ pauy; or 8.84 pauy.

What muft be given for a piece of filver weighing 73 lb. 5 oz. 15 dwts. troy, at the rate of 5 s. 9 d. per ounce? Anf. 253 £ 10 s. $0\frac{3}{4}$ d.

Bought

Bought 3 cwt. 1 qr. 7 lb. of raisins, what will they cost at 2 £. 6 s. 6 d. per cwt.?
Ans. 7 £. 14 s. 0 $\frac{1}{4}$ d.

A Garrison being besieged has five months provision in it, at the rate of 12 oz. a day for each man, but being informed that it cannot be relieved till after 9 months, how much a day must each man have that the provision may last that time?

Answer 6 $\frac{2}{3}$ oz.

What will the ground rent upon 846 r. 4 an. 6 pa. be, at the rate of 3 an. 3 pa. per rupee? Answer 171 r. 14 an. 4 $\frac{186}{192}$ pa.

What quantity of silver may I have for 507 pag. 22 fan. at the rate of 22 fan. 50 cash per oz. troy? Answer 84 lb. 1 oz. 7 dwts. 9 $\frac{123}{181}$ grs.

What must be paid for 1 mon 20 sr. 5 ck. of rice at 1 r. 2 an. per mon?
Answer 1 r. 11 an. 1 p.

What quantity of rice may be bought for 5000 pagodas at 75 $\frac{1}{2}$ pagodas per garce?
Answer 66 garce 18 par. 4 $\frac{648}{2718}$

A person failing in business owes to several persons 9052 Bombay rupees, 3 qrs, 50 reas, but agrees with them to pay 2 qrs, 50 reas per rupee, what must he pay them in all? Answer 5658 r. 0 qrs: 18 $\frac{3}{4}$ reas.

What must be paid for 7 Madras candies, 15 mons, 3 vis of sugar at 4 pag. 24 fan. per mon? Answer 697 pag. 20 fan. 60 cash.

A tradesman failing in business, agrees with his Creditors to pay 12 an. 3 pa. per rupee, and at that rate pays them in all 5658 r. 15 an. 6 pa. what was the debt?
Answer 7391 r. 4 an. 10.775 pa.

Bought 54 Bombay candies, 6 m. 5 sr. of pepper, for 5000 B. r. 2 qrs. 56 re. what did it cost per candy? Answer 92 r. 0 qrs. 32 $\frac{38560}{43445}$ reas.

If the ground rent on 7052 sa. r. 15 an. 6 pa. be 159 sa r. 4 an. 5 pa., at what rate is it per rupee? Answer 4 $\frac{455064}{1354170}$ pauy.

What must I pay for $\frac{3}{8}$ of a ship, which is valued at 70000 sicca rupees.
Answer 262250 sa. r?

What will the carriage of 8 mons, 30 sr. 3 ck, be, at 10 an. per sar.
Answer 218 r. 15 an. 1.57 pa.

What cost 30 pigs of lead, each weighing 1 By candy, 20 sr. 5 pa. at 32 Bombay rupees per candy? Answer 984 B. r. 0 qrs. 80 reas.

What must be paid for 450 Madras marcals of grain, at 75 st. pag. 15 fan. 20 cash per garce? Answer 84 pag. 34 fan. 2.5 cash.

If 5 guz of cloth cost 7 sa. r. 2 an. what must I pay for 9 pieces, each containing 21 $\frac{1}{4}$ guz? Answer 272 sa. r. 8 an. 6 pa.

If

If a Gentleman's income be 3600 sicca rupees a year, how much must he spend per month to save 1000 rupees a year? Answer 261 r. 10 an. 8 pa.

Suppose I buy 1 oz. of tea for $7\frac{1}{2}$ d. how much must I pay for 1 cwt? Answer £ 56.

Bought 75 cwt. 1 qr. 13 lb. tobacco, which cost 387 £. 15 s. 8 d., how much did it cost per lb. Answer 11 $\frac{217}{8441}$ d.

If 1 lb. of tobacco cost $6\frac{1}{4}$ d, how much may be bought for 111 £. 15 s. 6 d.
Answer 35 cwt. 1 qr. 26 lb.

A Grocer bought 2 cwt. 1 qr. 14 lb. of cloves, which cost him 32 £. 4 s. and he gained £. 5 by the bargain, at what rate did he sell it per lb.

Answer 2 s. 9 d. $\frac{1}{2}$ $\frac{116}{266}$ grs.

Suppose I have by me 300 yards of Irish Linnen which cost me £. 80, but some damage having happened to it, I am willing to lose 6 £. 10 s. by the whole, at what rate then must I sell it per yard. Answer 4 s. 10 $\frac{1}{4}$ $\frac{6}{30}$ d.

An Oilman bought 3 tons of oil, which cost him 151 £. 14 s: it so chanced that it leaked out 85 gallons, but he is desirous to sell it again, so that he may be no loser, how much must he sell it for per gallon. Answer 4 s. $6\frac{1}{4}$ $\frac{25}{671}$ d.

Suppose a Bankrupt owes £. 3000 and has in money, goods and recoverable debts 800 £. 12 s. $9\frac{1}{4}$ d, now suppose those things delivered to his Creditors what do they get per pound. Answer 5 s. 4 $\frac{615}{3000}$.

Suppose a person fails in trade and compounds with his Creditors to pay them 12 s. 6 d. in the pound; how much doth he owe, when all his cash and effects amounts only £. 700. Answer 1120 £.

A woman bought 496 eggs at 2 for a penny, and 294 eggs at 3 for a penny, which she sold out together at 5 for two pence, I wish to know whether she gained or lost by the bargain and how much. Answer she lost 2 s. 6 d.

If 100 £. principal, gain 5 £. interest, in 12 months what will £. 40 gain in the same time. Answer £. 2.

A man sold a parcel of cloths for 2 s. 10 d. per yard, on three months credit and found he gained 25 £. per cent. by them, what did they cost him per yard.
Answer 2 s. 8 d.

I owe my khansumah wages for 9 days, what must I pay him at the rate of 7 sa. r. per month of 30 days. Answer 2 r. 1 an. 2 pn. 8 gun.

Bought 75 bazar mons, 5 sr. 3 ck. of sugar for 387 sa. r. 15 an. 4 pa. besides which the charges for godown rent, and cooly hire amounted to 29 sa. r. 7 an., how much does it cost per sar. Answer 2 an. 2 p. $\frac{32082}{48083}$.

If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a pound, what will $\frac{3}{5}$ of an English ell cost at that rate.
Answer £. 2.

If

If $2\frac{2}{5}$ yards of cloth, cost £. $3\frac{3}{4}$; what will $4\frac{4}{5}$ yards cost at the same rate.

Answer 7 £. 10 s.

Bought 36 pipes of wine for 1221 sa. r. 15 an. 4 pa., how may I sell it per pipe to save one for my own use, and lose nothing on the purchase.

Answer 34 sa. r. 14 an. $7\frac{1}{3}$ pa.

What will 4 months and two days salary amount to at 275 sa. r. per month.

Answer 1118 sa. r. 5 an. 4 pa.

## THE RULE OF THREE INVERSE.

EVERY question in the rule of three may be divided into two parts, that is a supposition, and a demand, and of the three given number, two are always found in the supposition, and only one in the demand;

The rules given in the rule of three direct, are so framed as to preclude the distinction of direct, and inverse, or to render it unless, the left hand term being always the divisor: yet the direct questions being plainer in their own nature, and more easily comprehended by the Learner, I have exemplified the rules in a variety of questions of the direct kind, and shall now give a few of such, as are inverse.

When the divisor happens to be the extreme found in the supposition, the proportion is called DIRECT; but when the divisor happens to be the extreme in the demand, the proportion is called INVERSE.

*EXAMPLES.*

If 8 men can do a piece of work in 12 days, in how many days will 16 do the same?

If this question the supposition is, If 12 men can do a piece of work in 12 days; and the two terms contained in it are 8 men, and 12 days; the demand lies in these words, In how many days will 16 men do the same? and the only term contained in it is 16 men.

```
16 . . . : . . . 12 . . . : . . . 8
                  8
                 ---
              16)96
                 ---
            Days  6 Answer.
```

It is obvious that the answer must be less than the middle term; for 16 men will do the work in fewer days than 8 men, and therefore by Rule 2. the greatest extreme 16 is the divisor, which I place on the left hand, and the other extreme on the right, then proceed as before; and because the extreme found in the demand happens to be the divisor, the proportion is inverse.

If 30 yards of cloth that is 5 quarters broad, be required to hang a bed; how many yards of three quarters broad will serve the same purpose? Answer 50 yards.

If 1200 lb. weight be carried 36 miles for a sum of money, how many miles ought 1800 lb. to be carried for the same sum? Answer 24 miles.

If

If 100 £. in 12 months, gain a ſum of intereſt, what principal will gain the ſame ſum of intereſt in 8 months? Anſwer 150 £.

If I borrow of a friend 64 rupees for 8 months, what ſum ought I to lend him for 12 months, in order to requite the favor? Anſwer 42 r. 10 an. 8 pa.

If I lend a perſon 300 rupees for a year, how long ought he to lend 500 rupees to requite me. Anſwer 219 days.

## COMPOUND PROPORTION,

OR

## THE RULE OF FIVE DIRECT.

IS ſo called from its having five numbers or terms given to find a ſixth.

The given terms may be divided into two parts, viz. a ſuppoſition and a demand, three of which are always found in the ſuppoſition, and two in the demand.

The ſuppoſition and demand being diſtinguiſhed, proceed to ſtate the queſtion, that is, to put the terms in due order for operation, according to the following rules direct.

*RULE* 1.—Place that term of the ſuppoſition which is of the ſame kind as the number ſought, in the middle. The remaining terms are extremes, which muſt be claſſed into ſimilar pairs, by making each pair conſiſt of one term taken from the ſuppoſition and another of the ſame kind taken from the demand.

2.—Out of each ſimilar pair joined with the middle term, form a ſimple queſtion. and in each ſimple queſtion ſo formed, find the diviſor; viz. conſider from the nature of the queſtion, whether the anſwer muſt be greater or leſs, than the middle term; and if the anſwer muſt be greater, the leaſt extreme is the diviſor; but if the anſwer muſt be leſs than the middle term, the greateſt extreme is the diviſor.

3.—Place all the diviſors, on the left hand and the other extremes on the right, then multiply the diviſors or extremes on the left together for a diviſor; and multiply the extremes on the right hand and the middle term, continually for a dividend, and laſtly divide the dividend by the diviſor; and the quotient is the anſwer of the ſame name with the middle term. See General Rule in Simple Intereſt.

NOTE.

*NOTE.*—In every simple question, when the divisor is an extreme found in the supposition, the proportion is direct, but when the divisor is an extreme found in the demand, the proportion is inverse.

The three rules delivered above are so calculated as to make no difference between direct and inverse, or so as to render that distinction needless, the left hand extremes being all divisors, but yet, as questions consisting entirely of direct proportions, are the plainest and easiest, I will, in the first place, exemplify the rules by questions of the direct kind; and afterwards introduce such as are inverse.

*PROOF.*—Is by two statings in the single rule of three; in the following manner viz.

The middle term with one pair of similar extremes, make the first simple question; and the answer to this question, must be made the middle term to the next similar pair of extremes, and the answer to the last simple question is the answer; from thence, this rule is frequently called the DOUBLE RULE OF THREE.

But the joint operation prescribed by Rule 3, is a shorter as well as easier method; for in working some of the simple questions there may happen to be a remainder, and consequently the middle term of the next simple question, will have some fractional part, which inconveniency is avoided by working jointly.

*EXAMPLES.*

If 14 horses eat 56 bushels of corn in 16 days, how many bushels will 20 Horses eat in 24 days.

| HORSES. | BUSHELS. | HORSES. |
|---|---|---|
| 14.. | ...56... | ...20 |
| days 16 | | 24 days. |
| 224 | | 480 |
| | | 56 |
| | | 288 |
| | | 240 |
| | | 224)26880(120 bush. |
| | | 0 |

The supposition is; If 14 horses, in 16 days, eat 56 bushels of corn, and the three terms contained in it are, 14 horses, 56 bushels and 16 days; the demand is; How many bushels will 20 horses eat in 24 days? and the two terms contained in it are 20 Horses, and 24 days. Now, the number sought is bushels, and the term in the supposition of the same kind is 56 bushels, therefore by Rule 1. place it in the middle; then, the remaining four terms are extremes, which I class into similar pairs, by making each pair consist of one term taken from the supposition, and another of the same kind taken from the demand, thus, 14 horses and 20 horses, make one pair; again 16 days and 24 days make another pair.

Out

Out of the several similar pairs, joined with the middle term, I form so many simple questions, according to rule 2, viz. I say

1.—If 14 horses eat 56 bushels in a certain number of days, how many bushels will 20 horses eat in the same time?

2.—If 16 days eat up or consume 56 bushels, how many bushels will 24 days consume?

In the first simple question it is obvious, that the answer will be greater than the middle term, for 20 horses, will eat more than 14 horses will do in the same time, and so the least extreme, 14, is the divisor, and because 14 is an extreme found in the supposition, the proportion is direct.

In the second simple question it is also plain, that the answer will be greater than the middle term, for 24 days will consume more bushels than 16 days; and consequently the least extreme 16, is the divisor, and because 16 is an extreme found in the supposition, the proportion is direct; proceed as directed in rule 3.

*PROOF.*

| H. | B. | H. | DAYS. | B. | DAYS. |
|---|---|---|---|---|---|
| If 14 . : . | 56 . : : . | 20 | If 16 . : . | 80 . : : | 24 |
| | 20 | | | | 80 |
| | 14) 1120 (80 B. | | | | 16) 1920 (120 |
| | 0 | | | | Answer 120 bushels as before. |

You may contract your work in the manner prescribed in the " single rule of three"; thus;

$14)\ \frac{14}{56}=\frac{1}{4}$ . . . . . 1 . . : . . 4 . . : : . . 20

$16)\ \frac{16}{24}=\frac{1}{1\frac{1}{2}}$ . . . . . 1 . . : . . 30 . . : : . . $1\frac{1}{2}$

Answer 120     30

If the interest of 100 sicca rupees for 1 year or 365 days, is 12 rupees; what will be the interest of 5780 rupees for 120 days?

```
100 . : . 12 . : . . 5780
365       :          120
---                  ---
36500               693600
                      12
                   ----   Sa. Rs.
          365'00)83232'00(228 0 6 114/365
               730
               ---
               1023
                730
               ----
                2932
                2920
                ----
                  12
                  16
                 --
           365)192(0 an.
                 12
                ---
          365)2304(6 pa.
               2190
               ----
          Rem. 114
               ---
```

Contracted by Decimals, thus;

```
12)36500  : 12 : : 5780
   3041.6 :  1 : :  120
   ------           ---
   3041.6)       693600.0(
    3041          693600
   ------        -------
   27375)        6242400(228.0328
                 ----  -
         Rem. 21000
Answer Sa. Rs. 228.0328 &c.=0 6.3.
```

If 14 horses eat 328 sars of Gram in 16 days, how many sars will 20 horses eat in 24 days. Answer 702 sars 13 $\frac{160}{224}$ cks.

If 40 beegahs of grass be cut down by 8 men in 7 days; how many beegahs shall be cut down by 24 men in 28 days. Answer 480 beegahs.

If 6 men receive 40 sa. r. 15 an. for 40 days work; how many men must be paid with 215 sa. r. 3 an. for 16 days work. Answer 78 men.

If a carrier receive 42 shillings for the carriage of 3 cwt. 150 miles; how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. 50 miles. Ans. 1 £ 16 s. 9 d.

## RULE OF FIVE INVERSE.

THE questions that fall under this rule, have commonly one of the proportions inverse, and the other direct; and some times the upper and some times the lower, is the inverse proportion; and in some few questions both proportions are inverse. Though the three rules given in the "Rule

of

of five direct," make no difference betwixt direct and inverse; yet, to bring the learner to an acquaintance with this useful distinction, I shall in stating the following question, expose the same to view, by affixing an asterisk to the extremes of the inverse proportion.

*EXAMPLES.*

If 14 horses eat 56 fars of gram in 16 days; in how many days will 20 horses eat 120 fars?

In this question the supposition is; that 14 horses, eat 56 fars in 16 days; and the demand is, in how many days 20 horses will eat 120 fars.

```
*20 . : . 16 . : : . 14*
 56                  120
----                ----
1120                1680
                      16
                    ----
           112'0)2688'0(24 days
```

The number sought is days, and the term in the supposition of the same kind is days 16, and accordingly I place 16 days in the middle. The remaining four terms are extremes, which I class into similar pairs, by making each pair consist of one term taken from the supposition and another of the same kind taken from the demand, thus: 14 horses and 20 horses make one pair; again 56 fars and 120 fars make another pair. Out of the similar pairs, joined with the middle term, I form so many simple questions, namely,

1.—If 14 horses eat a certain number of fars in 16 days, in how many days will 20 horses eat the same quantity?

2.—If 56 fars are eat up in 16 days; in how many days will 120 fars be eat up by the same eaters?

In the first simple question it is plain that the answer must be greater than the middle term; for 20 horses will eat the same number of fars in fewer days than 14 horses, and so the greatest extreme, 20, is the divisor; and because 20 is an extreme found in the demand, the proportion is inverse.

In the second simple question it is also obvious, that the answer must be greater that the middle term; for 120 fars will require more days to be eat up in, than 56 fars, and therefore the least extreme, 56, is the divisor; and because 56 is an extreme found in the supposition, the proportion is direct; then multiply and divide as before direct.

Contractions. $560)\ \frac{1120}{1680} = \frac{2}{3}$. $2)\ \frac{2}{16} = \frac{1}{8}$

```
above statement resumed 1120 . . : . . 16 . . : : 1680
contracted thus            2 . . : . . 16 . . : : . . 3
or                         1 . . : . .  8 . . : : . . 3
                                        3
                                       --
                                Answer 24 days.
```

PROOF.—BY TWO STATINGS.

```
*20 . . . : 16 : : . . 14*: 11 days 4 h. 48 min.
 56 . . . : 11 days . 4 h. 48 min : : 120 : 24
                 Answer 24 days.
```

If

If 40 beegahs of grass be cut down by 8 men in 7 days; in how many days will 480 beegahs be cut down by 24 men. Answer 28 days.

If 100 £. principal in 12 months, gain 5 £. interest; what principal will gain 2 £. 16 s. 3 d. interest in 9 months. Answer £. 75.

If a carrier receive 42 shillings for the carriage of 3 cwt. 150 miles; how many miles ought he to carry 7 cwt. 3 qrs. 14 lb. for 36 s. 9 d. Answer 50 miles.

If 8 men in 5 days earn 40 shillings wages, in how many days will 32 men earn 38 £. 8 s. Answer in 24 days.

If a person travels 300 miles in 10 days, when the day is 12 hours long; in how many days may he travel 600 miles, when the day is 16 hours long. Ans. 15 days.

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# PRACTICE.

PRACTICE derives its name from its general use among merchants and others concerned in trade and business.

All questions in the Rule of three, where the first term is one or 1, may be performed by this rule, in a more concise way, by taking aliquot or even parts, by which means many tedious reductions may be avoided; but as there are great variety of such parts, so many therefore are the ways of applying them, that it would be an endless task, to give all the easy methods of operation adapted to every particular case, so I shall only give the general rules with a sufficient number of Examples to each.

A number which measures another is called an aliquot part; as, 4 pauy is $\frac{1}{3}$ of one anna or 12 pauy; 2 annas is $\frac{1}{8}$ of a rupee or 16 annas; 10 sars is $\frac{1}{4}$ of a mon, or 40 sars; &c.

*P R O O F.*—You may prove your work by Decimals, or by the Rule of three.

1.—When the price is less than one anna.

*R U L E.*—Take the aliquot part or parts that are in one anna; add them together and the sum will be the answer in annas, which divided by 16 (annas in a rupee) will give the answer.

*N O T E.*—Questions in any other money are computed after the same method, observing to take aliquot parts of the next higher denomination.

EXAMPLES.

## *EXAMPLES.*

What must I pay for 1762 fars of Rice at 1 pauy per far?

Here, 1 pa. is the $\frac{1}{12}$th part of an anna, therefore divide the given quantity 1762 by 12 and the quotient is 146 an. 10 pa.; which divided by 16 gives the answer 9 r. 2 an. 10 pa.

| | | | |
|---|---|---|---|
| 1 pa. . . is . . $\frac{1}{12}$ | 1762 | | |
| | 16)146 | 10 | |
| Answer Rs. | 9 | 2 | 10 |

OR THUS

$$
\begin{array}{rr}
\text{1 pa. is equal to} & .0052083\dot{3} \\
 & 1762 \\
\hline
 & 10416\dot{6} \\
 & 3125000 \\
 & 3645833\dot{3} \\
 & 5208333\dot{3} \\
\hline
\text{Rs.} & 9.17708\dot{3} \\
 & 16 \\
\hline
\text{Answer} & 2.8\dot{3} \\
 & 12 \\
\hline
\text{Pa.} & 10.0
\end{array}
$$

Answer 9 r. 2 an. 10 p. as before.

What must I pay for 1762 lb. of Pepper at 5 pauys per lb.

In this example 5 pa. the given price is not an even part of one anna, it must therefore be divided into even parts, thus: first I take $\frac{1}{3}$ for 4 pa.; that is I divide the given quantity by 3, which gives 587 an. and 1 an. over, equal to 12 pa., and that divided by 3 gives 4 pa. and makes the quotient 587 an. 4 pa.; then I take $\frac{1}{12}$ for 1 pa. which gives 146 an. 10 pa.; those quotients added together make 734 an. 2 pa., and that sum divided by 16 gives the answer 45 r. 14 an. 2 pa.

| P | | | | |
|---|---|---|---|---|
| | | 1762 | | |
| 4 is | $\frac{1}{3}$ | 587 | 4 | |
| 1 is | $\frac{1}{12}$ | 146 | 10 | |
| 5 | 16) | 734 | 2 | |
| Answer Rs. | | 45 | 14 | 2 |

PROOF.

*PROOF.*

**THUS**

| | lb. | pa. | | lb. | |
|---|---|---|---|---|---|
| If 1 coft | | 5 | what will | 1762 | coft |

```
              1762
                 5
         12)8810
         16) 734  2
Anfwer  Rs. 45 14 2
```

**OR THUS.**

```
5 pa. is equal to .0260416
                    1762
                  520833
                15625000
              182291666
              260416666
          Rs. 45.885416
                     16
          an. 14.16
                 12
          pa. 2.0 Ans. 45 r. 14 an 2 pa.
```

What will 1762 Limes coft at 11 pauys each?

This queftion requires three aliquot or even parts; thus; firft, take $\frac{1}{2}$ for 6 pa.; then $\frac{1}{3}$ for 4 pa.; and then $\frac{1}{12}$ for 1 pa.; proceed as before and the anfwer is 100 r. 15 an. 2 pa.

```
                    1762
   6 is   1/2       881
   4      1/3       587  4
   1      1/12      146 10
Pa. 11         16)1615   2
     Ans. Rs.     100 15  2
```

PROOF.

*PROOF.*

| Lime | Pa | Limes | or thus |
|---|---|---|---|
| If 1 : cost 11 :: what will 1762 cost. | | | 11 pa. is equal to .0572916 |

```
              1762                      .0572916
                11                          1762
            ------                   -----------
          12)19382                      1145833
            ------                     34375000
          16)1615  2                  401041666
            --------                 5729166666
Answer. Rs. 100 15 2                -------------
            --------             Rs. 100 947916=15  2
                                         -------
                                 An. 15.16
                                        12
                                        --
                                 Pa.   2.0
                                        --
```

What will 756 mangoes cost, at 2 pauys each? Answer 7 r. 14 an.

What will 7050 cocoanuts cost, at 3 pauys each? Answer 110 r. 2 an. 6 pa.

What will 672 peaches cost, at 4 pauys each? Answer 14 r.

What will 576 fish cost, at 27 reas each. Answer 38 r. 3 qrs. 52 reas.

What will 767 plumbs cost, at $\frac{3}{4}$ d. each? Answer 2 £ 7 s. 11$\frac{1}{4}$ d.

What will 767 walnuts cost, at 45 cash, each? Answer 9 pag. 26 fan. 35 c.

2.—When the price is less than a rupee.

*RULE.*—Take the aliquot part or parts that are in a rupee, add as in the last case, and the sum is the answer; but when the given price is in pence, divide the sum by 20, which gives the answer in pounds, &c. See Note, in the foregoing case.

*EXAMPLES.*

What will 1762 yards cost 6 annas per yard?

Here, I take $\frac{1}{4}$ for 4 an.; because 4 an. is $\frac{1}{4}$ of a rupee or 16 annas; then, for the same reason, I take $\frac{1}{8}$ for 2 an.; or, it would be the same if I took $\frac{1}{2}$ of the quotient of 4 an., because 2 an. is $\frac{1}{2}$ of 4 an.

```
                 1762
                 ----
4 an. is 1/4      440   8
2 an. is 1/8      220   4
                 --------
Ans. Rs.          660  12
                 --------
```

PROOF.

**PROOF.**

| | yd. | | an. | | yards. | | or thus |
|---|---|---|---|---|---|---|---|
| If | 1 | cost | 6 | :: what will | 1762 | cost. | 1762 |
| | | | | | 6 | 6 an. is equal to | .375 |
| | | | | 16) | 10572 | Rs. | 660.75 |
| | | | | Ans. Rs. | 660 12 0 | or | 660r. 12 an. |

*NOTE.*—When the given price consists of annas and pauys, you may multiply the given quantity by the annas, and take aliquot parts of an anna, for the pauys, as before.

1762 fars at 5 an. 3 pa. per far?

Here, I take $\frac{1}{4}$ for 4 an.; and $\frac{1}{4}$ of 4 an. for 1 an. also, for 3 pa., I take $\frac{1}{4}$ of 1 an., all which added together gives the answer, 578 r. 2 an. 6 pa.

| a. | p. | | | 1762 |
|---|---|---|---|---|
| 4 | | is | $\frac{1}{4}$ | 440 8 |
| 1 | | | $\frac{1}{4}$ | 110 2 |
| 0 | 3 | | $\frac{1}{4}$ | 27 8 6 |
| 5 | 3 | | Rs. | 578. 2 6 |

or thus.

| | |
|---|---|
| | 1762 |
| | 5 an. |
| p. | 8810 |
| 3 is $\frac{1}{4}$ | 440 6 |
| | 16)9250 6 |
| Rs. | 578 2 6 Ans. |

Proof

| | | |
|---|---|---|
| If 1 : | 5 3 :: | 1762 |
| | 12 | 63 |
| | 63 | 5286 |
| | | 10572 |
| | | 12)111006 |
| | | 16 9250 6 |
| | Rs. | 578 2 6 |

or thus.

5 an. 3 p. = .328125
1762
Rs. 578.156250
16
an. 2.5
12
pa. 6.0
or 578r. 2an. 6.

3741 yards at 5 an. 4 pa. per yard.

It frequently happens that the given price in annas and pauys, is an aliquot part of a rupee (as in this example), in which case divide by the aliquot parr and the quotient is the answer.

| a. p. | | 3741 |
|---|---|---|
| 5 4 | is $\frac{1}{3}$ | 1247 Rs. Ans. |

1762 fars at 3 an. 3 pa. per far. Answer 357 r. 14 an. 6 pa.

1762 fars at 4 an. 6 pa. per far. Answer 495 r. 9 an.

1762 fars at 7 an. 9 pa. per far. Answer 853 r. 7 an. 6 pa.

1762 fars at 15 an. 4 pa. per far. Anfwer 1688 r. 9 an. 4 pa.
1762 fars at 11 an. 5 pa. per far. Anfwer 1257 r. 4 an. 2 pa.
1762 vis at 16 fanams per vis. Anfwer 626 pag. 22 fan.
1762 vis at 15 fan. 20 c. per vis. Anfwer 597 pag. 5 fan. 40 c.
7550 fars at 3 qrs. of a rupee per far. Anfwer 5662 Bom. r. 2 qrs.
7550 fars at 2 qrs. 27 reas per far. Anfwer 4284 Bom. r. 2 qrs. 50 reas.
6780 lb. at $1\frac{1}{4}$d. per lb. Anfwer 45£. 8s. 9d.
6780 lb. at $2\frac{1}{2}$d. per lb. Anfwer 70£. 12s. 6d.
6780 lb. at $7\frac{3}{4}$d. per lb. Anfwer 218£. 18s. 9d.
6780 lb. at $11\frac{1}{2}$d. per lb. Anfwer 324£. 17s. 6d.
6780 lb. at 2s. $6\frac{1}{4}$d per lb. Anfwer 86 £. 13s. 9d.
5620 lb. at 8 an. 6 pa. per lb. Anfwer 2985 r. 10 an.
5620 lb. at 41 fan. 15 c. per lb. Anfwer 5143 pag. 8 fan. 60 c.
5620 lb. at 3 qrs. 20 reas. per lb. Anfwer 4496 Bom. r.
5620 lb. at 15s. $7\frac{1}{2}$d. per lb. Anfwer 4390£ 12s. 6d.

3.—When the price is given in rupees.

*R U L E.*—Multiply the given quantity by the price; the product is the anfwer.

*E X A M P L E S.*

What will 825 fars coft at 25 rupees per far?
25
Rs. 20625 Anfwer.

165 lb. at 46 pagodas per lb. Anfwer 7590 pagodas
157 lb. at 15 £. per lb. Anfwer 2355 £.

4.—When the given price is in Rupees; Pagodas. &c. and their fractional parts; as, annas and pauy; fanams and cafh; &c.

*R U L E.*—Multiply the given quantity by the rupees, and take aliquot parts for the annas and pauy, according to cafe 2. See Note; cafe 1.

*E X A M P L E S.*

What will 5040 Sheep coft at 4r. 12 an. each?

| | | | *P R O O F S.* |
|---|---|---|---|
| | 4 | If 1 . . : . . 4 12 . . : : . . 5040 | R. A. 5040 |
| an. | 20160 | 16 76 | 4 12 = 4.75 |
| 8 . . . . $\frac{1}{2}$ | 2520 | | |
| 4 $\frac{1}{2}$ | 1260 | 76 16)383040 | Rs. 23940. |
| Anfwer . . Rs. | 23940 | Anf. Rs. 23940 | |

What

What will 1525 yards cost, at 6 r. 11 an. 10 pa. per yard?

*PROOFS.*

```
                 1525          If 1 . . . . : 6  11  10 . . . . . . : : . . 1525
                    6                        16                                1294
                 ----                       ---                              -------
An. pa.          9150                       107                            12)1973350
8  — is 1/2       762  8                                                    -------
2  —    1/4       190 10                     12                          16)164445 10
1  —    1/2        95  5                    ---                             ------
—   6   1/2        47 10  6                1294                        Rs. 10277 13 10 Answer
—   4   1/3        31 12  4                 ---
------------   ------------              A.  an. pa.     or thus.
11  10 Rs.  10277 13  10                  6  11  10 =  6.739583
                                                        1525         Rs.  a.  p.
                                                     -------
                                         Rs. 10277.8645 &c. or 10277 13 10
```

| yards. | | rs. | an. | pa. | |
|---|---|---|---|---|---|
| 731 | at | 6 | 8 | 0 | per yard. Answer 4751 r. 8 an. |
| 924 | at | 9 | 12 | 0 | ——— Answer 9009 r. |
| 812 | at | 8 | 1 | 0 | ——— Answer 6546 r. 12 an. |
| 6418 | at | 2 | 5 | 0 | ——— Answer 14841 r. 10 an. |
| 200 | at | 7 | 1 | 4 | ——— Answer 1416 r. 10 an. 8 pa. |
| 739 | at | 6 | 3 | 9 | ——— Answer 4607 r. 3 an. 3 pa. |
| 729 | at | 7 | 3 | 11 | ——— Answer 5281 r. 7 an. 3 pa. |
| 900 | at | 9 | 15 | 11 | ——— Answer 8995 r. 5 an. |
| 641 | at | 31 | 5 | 4 | ——— Answer 20084 r. 10 an. 8 pa. |
| 1525 | at | 5£.10s.6d. | | | ——— Answer 8425 £. 12 s. 6. d. |

5.—When the given quantity is less than 12; or such a number that any two figures in the multiplication table being multiplied together will produce it.

*RULE.*—Multiply the given price, by the given quantity, or by the component parts, by cases 2 and 3 in compound multiplication.

*EXAMPLES.*

What will 50 Cows cost at 10 r. 8 an. 6 pa. each?

thus

| THUS | | | | OR THUS. | | PROOF. | |
|---|---|---|---|---|---|---|---|
| | 10 8 6 | | | 50 – – | If 1 ... r ... 10 8 6 ... : ... 50 | | |
| | 5 | | | 10 – – | | 16 | 2022 |
| 5=10×50 | | | | | | | |
| | 52 10 6 | | | 500 – – | | 168 | 12)101100 |
| | 10 | 8 a. $\frac{1}{2}$ | | 25 – – | | | |
| | | 6 pa. $\frac{1}{16}$ | | 1 9 0 | | 12 | 16)8425 |
| Ans. Rs. | 526 9 0 | | | | | 2022 | Rs. 526 9 0 |
| | | | | Rs. 526 9 0 | | | |

11 maunds at 17 r. 14 an 6 pa. each. Ans. 196r. 15 an. 6 pa.

8 maunds at 64 r. 10 an. 8 pa. each. Ans. 517 r. 5 an. 4 pa.

55 maunds at 14 r. 6 an. 2 pa. each. Ans. 791 r. 3 an. 2 p.

144 maunds at 19 r. 15 an. 7 pa. each. Ans. 2876 r. 4 an.

45 maunds at 20 pag. 20 fan. each. Ans. 920 pag.

36 maunds at 50 Bom. r. 3 qrs. each. Ans. 1827 Bom. Rs.

56 maunds at 5 £. 14 s. 6¼ each. Ans. 320 £. 15 s. 6 d.

6.—When both the price and quantity given confift of feveral denominations; as, mons, fars, &c.; and rupees, annas, &c.

*R U L E.*—Multiply by the price of quantity given, and take aliquot parts for the fars, &c.; add them together, and the fum will be the anfwer.

*E X A M P L E S.*

What is the value of 18 mons, 15 sr. 14 ck. at 6 r. 5 an. 4 pa. per mon?

| | | | R. | an. | pa. |
|---|---|---|---|---|---|
| | | | 6 | 5 | 4 |
| 2×9=18. | | | | | 2 |
| | | | 12 | 10 | 8 |
| | | | | | 9 |
| far | ck | | 114 | 0 | 0 |
| 10 | | $\frac{1}{4}$ | 1 | 9 | 4 |
| 5 | | $\frac{1}{2}$ | | 12 | 8 |
| | 8 | $\frac{1}{10}$ | | 1 | 3.2 |
| | 4 | $\frac{1}{2}$ | | | 7.6 |
| | 2 | $\frac{1}{2}$ | | | 3.8 |
| 15 | 4 | Rs. | 116 | 8 | 2.6 Anfwer. |

```
M. . . r . . . . 6-5-4 . . . : : . . . . 18 15 14
   40       16            40
   --       --            --
   40      101           735
   16       12            16
   --       --            --
  640     1216         11774
   --       --          1216
                        ----
              640)14317184(12)22370
                  --------     -----
              Rem. 384/640=.6  16)1864  2
                               --------
                               Rs. 116  8  2
                                   ---------

       an. pa.                     OR THUS.
        5 . 4=6.3             .18.3969=15 fr. 14 ck.
                6                      57
                -                    -----
See. Cafe 5 Multiplication of Decimals . num. 57    9)1048.6233
                                         den..  9   --------
                                            Rs. 116.5137
                                                --------
                                        or Rs. 116 8 2.5
                                                --------
```

| Mons | fr. | ck. | | |
|---|---|---|---|---|
| 55 | 18 | 5 | at 14 an. 5 pa. per mon. | Anfwer 49 r. 15 an. 6 pa. |
| 77 | 25 | 15 | at 4 r. 6 an. per mon. | Anfwer 339 r. 11 an. 4.6 pa. |
| 99 | 1 | 4 | at 8 r. 8 an. per mon. | Anfwer 84 r. 12 an. 3 pa. |
| 6 | 2 | 8 | at 5 r. 4 an. per mon. | Anfwer 31 r. 13 an. 3 pa. |
| 12 | 8 | 4 | at 72 r. 8 an. per mon. | Anfwer 884 r. 15 an. 3 pa. |
| | 5 | 2 | at 25 r. 8 an. 4 pa. per mon. | Anfwer 3 r. 4 an. 3 pa. $\frac{8}{10}$ |

When the integer of the given quantity is large and fuch a number that no two figures in the multiplication table being multiplied together will produce it.

Work for the price of the integers as already taught in cafe 4; then take aliquot parts of the given price, with the fars, &c. add them together and the fum will be the anfwer.

Bought 5750 mons, 16 fars of rice at 2 r, 5 an, 6 pa, per mon: what does the whole amount to?

Mons

PROOF.

| | Mons. | far. | | Mn. | R. AN. PA. | Mons. far. |
|---|---|---|---|---|---|---|
| | 5750 | 16 | | If 1 | 2 3 6 | 5750 16 |
| | 2 | | | 40 | 16 | 40 |
| | 11500 | | | 40 | 35 | 230016 |
| 2an. ⅛ | 718 | 12 | | | 12 | 426 |
| 1 . ½ | 359 | 6 | | | 426 | 4,0)9798681,6 |
| 6p. ½ | 179 | 11 | | | | 12)2449679 16/40 = .4 |
| 8fr. 1/5 | 7 | 1.2 | | | | 16) 204139 2 |
| 8 1/5 | 7 | 1.2 | | | | |
| Rs. | 12758 | 11 | 2.4 Anfwer. | | | Rs. 12758 11 2.4 |

OR THUS.

2 r. 3 an. 6 pa. is equal to 2.21875
5750 m. 16 r. ———— 5750.4

Anfwer . . . . Rs. 12758.70 or Rs. 12758 11 2.4

*N O T E.*—When the decimals extend to many places, fhorten your work, according to Cafe in multiplication of decimals.

What will 420 oz. 15 dwts. 16 grs. troy, coft, at 3 £. 16 s. 10½ d. per ounce ? Anfwer 1617 £. 7 s. 8½ d.

What muft I pay for 15 mons, 4 pat. 3 fr. 2 po. 2 ck. 2 khaa., at 4 r. 15 an. 3 pun. per mon ? Anfwer 77 r. 11 an. 1 pn. 13 gun.

What muft I pay for 6 mons, 39 fr. 3 po. 3 ck.; at 25 r. 6 an. 3 pun. per mon ? Anfwer 177 r. 14 an. 2 pn. 9 gun.

5 Madras candy, 10 mon ; at 69 pag. 15 fan. per candy. Anfwer 381 pag. 15 fan.

75 garce, 50 par.; at 75 pag. 20 fan. per garce. Anfwer 5705 pag. 21 fan. 70 C.

5 Bombay candy, 5 mon ; at 75 r. 3 qrs. 50 reas per candy. Anf. 398 R. 1 q. 37 r.

14 cwt. 2 qrs. 21 lb., at 3 £. 17 s. 6 d. per cwt. Anfwer 56 £. 18 s. 3¼ .5 d.

73 ton. 17 cwt. 2 qrs, at 9 £. 12 s. 10 d. per tun. Anfwer 712 £. 5 s. 6¼.

Money of the fame denomination, may be multiplied together as follow :

Multiply

Multiply £. 19 19 11 ¾ by £. 19 19 11 ¾.

| | | £. | s. | d. | |
|---|---|---|---|---|---|
| | | 19 | 19 | 11 ¾ | |
| | | | | 3 | 3×6+1=19 |
| | | 59 | 19 | 11 ¼ | |
| | | | | 6 | |
| | | 359 | 19 | 7 ½ | |
| | | 19 | 19 | 11 ¾ | |
| s. d. | | 379 | 19 | 7 ½ | |
| 10 .... ½ | ..... | 9 | 19 | 11 ¾.5 | |
| 5 .... ½ | ..... | 4 | 19 | 11 ¾.75 | |
| 4 .... 1/5 | ..... | 3 | 19 | 11 ¾.8 | |
| 10 .. 1/6 | ......... | | 16 | 7 ¾.9583 | |
| 1 .. 1/10 | ......... | | 1 | 7 ¾.99583 | |
| ½ . ½ | ......... | | | 9 ¾.99791 | |
| ¼ . ½ | ......... | | | 4 ¾.99895 | |
| 19 11 ¾ | | £. 399 | 19 | 2 .001 | Anſwer. |

## By Decimals.

See. Caſe 6 in multiplication of decimals.

4) 3.
12) 11.75
20) 19.9791666
£. 19.9989583 equal to £. 19·19·11 ¾

199.989583
19 998958
179990625 Numerator
9000000 Denominator

19.9989583
179990625

9999479.16
39997916.66
119993750000
1799906250000
17999062500000
179990625000000
1399927083333333
1999895833333333

9)3599625009.7656250

Rs. 399.9583344184027 or Rs. 399 19 2.001.

After dividing by 9. I divide by 1000000, which is done by removing the decimal point six places to the left.

You may shorten your work by case in multiplication of decimals; or by the contractions, directed in the rule of three. thus:

As 9000000 : 179990625 :: 19.9989583 : 399.95 &c.
Or .0500026 : . . . . 1 . . . . :: 19.9989583 : 399.95 &c.

Here. I form the contraction by dividing the first and second terms, by the second term.

BY VULGAR FRACTIONS.

£. 19 19 11 $\frac{3}{4}$ is equal to 19 $\frac{959}{960}$ or $\frac{19199}{960}$, multiplied by $\frac{19199}{960}$ gives $\frac{368601601}{921600}$ which is equal to £. 399 19 2 $\frac{1960}{1}$ or .001 Ans. as before.

## BATTA.

THE difference in value between any kind of rupee and currency or current rupees (which is an imaginary coin), or between one kind and another is called BATTA.

There are many kinds of silver rupees in Bengal, but the sicca rupee is alone used or current in payments in business, and is meaned in all kinds of dealings or transactions, where it is not otherwise particularly expressed. See tables of Bengal Money.

A

A comparative view of the relative value of ſeveral denominations of rupees.

| | | C. R. | A. | | S. R. | A. | P. |
|---|---|---|---|---|---|---|---|
| 100 Sicca rupees . . . . . . | are equal to | 116 | . | or | 100 | | |
| 100 Arcot rupees . . . . . | ———— | 108 | . | — | 93 | 1 | 7.86 |
| 100 Bombay (Soortee) rupees . | | 110 | . | — | 94 | 13 | 2.895 |
| 100 Sunnaut rupees . . . . | | 111 | . | — | 95 | 11 | 0.446 |
| 100 Furruckabad rupees . . | | 112 | 8 | — | 96 | 15 | 8.7 |
| 100 Lucnow rupees . . . . | | 113 | 8 | — | 97 | 13 | 6.2 |
| 100 Current rupees . . . . | | 100 | . | — | 86 | 3 | 3.725 |

Miſtakes are frequently made by individuals in the calculation of BATTA, ariſing from their ignorance of the proper method or proportion between different kinds of rupees; for inſtance, in reducing current rupees into ſicca or 16 per cent rupees, they are apt to deduct 16 per cent. which makes 100 current, equal to 84 ſicca rupees, inſtead of 86 ſa. r. 3 an. 3.725 pa.; again, in reducing Arcot or 8 per cent rupees, into ſicca; or vice verſa; they are apt to add or deduct the difference in the centage, that is, 8 per cent; in which caſe 100 arcot rupees would be equal to 92 ſicca rupees, inſtead of 93 ſa. r. 1 an. 7.86 pa.; or, 100 ſicca be equal to 108 Arcot rupees, inſtead of 107 a. r. 6 an. 6.2 p.; and ſo on with the other kinds; they are therefore liable to be egregiouſly impoſed upon, which may be very eaſily obviated by attention to the following rules, which are deduced from this proportion, viz.

As the centage of the required rupees, added to 100:

Is to the centage of the given rupees, added to 100::

So is the given ſum: to the anſwer.

GENERAL RULE.

Multiply the given ſum by the centage of the given rupees added to 100. or by the component parts, according to caſes 2 and 3 in compound multiplication; then divide the product, by the centage added to 100, of the rupees you would have it reduced to, or if practicable by its component parts, according to caſe 2 in compound diviſion; and the quotient will be the anſwer.

*N O T E.*—You may contract your work as directed in the rule of three.

1.—To reduce ſicca or 16 per cent. rupees, to current rupees.

*R U L E.*—Multiply the given ſum by 116, and divide the product by 100, the quotient will be the anſwer.

EXAMPLES.

## EXAMPLES.

Reduce 79 sicca rupees, to current rupees.

By Rule . . . . . as 100 . . . : . . . 116 . . . :: . . . . 79

$\frac{100}{116}=\frac{25}{29}$

| | Contractions | | | |
|---|---|---|---|---|
| | 25 . . . : | . . . . 29 | . . . :: . . . . | 79 |
| 25) $\frac{25}{79}=\frac{1}{3.16}$ | 1 . . . : | . . . . 29 | . . . :: . . . . | 3.16 |
| 25) $\frac{25}{29}=\frac{1}{1.16}$ | 1 . . . : | . . . 1.16 | . . . :: . . . . | 79 |
| 29) $\frac{25}{29}=\frac{.862069}{1}$ | .862069 . . . : | . . . . . 1 | . . . :: . . . . | 79 |

BY THE RULE.

```
                       79
                      116
                      ---
                      474
                     869
                     ----
Ans. C. R. 91 10 2.88  91,64
                        16
                an. 10,24
                        12
                        --
                  p. 2,88
```

BY PRACTICE.

| | | Rs. | a. | p. |
|---|---|---|---|---|
| | | 79 | | |
| 10 . . . | $\frac{1}{10}$ | 7 | 14 | 4.8 |
| 5 . . . | $\frac{1}{2}$ | 3 | 15 | 2.4 |
| 1 . . . | $\frac{1}{5}$ | | 12 | 7.68 |
| Currt. Rs. | | 91 | 10 | 2.88 Answer. |

Reduce 79 sa. r. 14 a. 3 p. to current rupees.

BY RULE.

```
     79    14    3
                 9×12+8=116
    ---------------
    719     0    3
                12
    ---------------
   8628     3    0
    639     2    0
   ----------------
10)9267     5    0   10×10=100.
   ----------------
10) 926    11    8
   ----------------
C. Rs. 92  10    9.24 Answer.
```

OR THUS.

```
     79    14    3
                 4×7+1=29
    ---------------
    319     9    0
                 7
    ---------------
   2236    15    0
     79    14    3
   ----------------
 5)2316    13    3   5×5=25
   ----------------
 5)463      5   10.2
   ----------------
C. R. 92   10    9.24
```

OR THUS. A. P.

```
  79.890625=14  3
        1.16
  ------------
R. 92.673124 or R.  92  10  9.24
        16           ------------
  --------
A. 10.769984
          12
  --------
P.  9.239 &c.
  --------
```

BY PRACTICE.

```
             79  14   3
10 . 1/10 .   7  15   9.9
 5 . 1/2  .   3  15  10.95
 1 . 1/5  .      12   9.39
            ---------------
             92  10   9.24
            ---------------
```

In 746 ſicca rupees, how many current rupees? Anſ. 865 r. 5 an. 9.12 p.

In 576 ſa. r. 15 an. 11 p. how many current rupees. Anſ. 669 r. 5 an. 0.28 p.

Reduce 9 an. 3 p. ſicca, to currency. Anſwer. 10 a. 8.76 p.

2.—To reduce current rupees to ſicca rupees.

*RULE.*—Multiply the given ſum by 100, and divide the product by 116; the quotient will be the anſwer.

*EXAMPLES.*

Reduce 100 current rupees to ſicca rupees.

BY RULE.

```
     100
      100
     ------ sa. r. a. p. 84
116)10000( 86   3   3 116   Anſ.
     928
     ----
      720
      696
      ---
       24
       16
      ---
116 )384( 3 an.
     348
     ---
      36
      12
      --
116 )432 ( 3 p.
     348
     ---
      84 rem.=.7
      --
```

CONTRACTED, SEE CONTRACTIONS LAST CASE. EX.

```
        .862069
            100
        --------
Sa. R. 86.2069
            16
        ------
   a.   3.3064
            12
        ------
   p.   3.67 &c.
        ----
Sa. R. 86  3  3.6
      -----------
```

OR THUS.

```
116) 10000. (86.2068=3  3.7
     ------   -------
  Rem. 112
```

Reduce

Reduce 5 c. r. 5 an. 6 p. to sicca rupees.

By general rule

```
                5  5  6
10×10=100:            10
               ---------
               53  7  0
                      10
               ---------  Sa. R.  a.  p.
116.)534  6  0(  4     9   8 56/116
     464
     ---
      70
      16
     ---
116 )1126( 9 a.
     1044
     ----
       82
       12
     ----
116 )984( 8 p.
     928
     ---
      56
```

OR THUS.

```
   5  5  6
         5
  ---------
  26 11  6
         5
  ---------  S. R.  a.  p.
29)133  9  6(  4  9  8 14/29
   116
   ---
    17
    16
   ---
29)281(9 a.
   261
   ---
    20
    12
   ---
29)246(8 p.
   232
   ---
    14
```

BY DECIMALS.

```
12 )6.
16 )5.5
                 a. p.
   5.34375 = 5  6
        100
   --------  Sa. R.  a.  p.
116 )534.375( 4.606 = 9  8
     464         16
     ---       -----
      703      9.696
      696         12
      ---      -----
       775     8.3 &c.
       696
       ---
        79
```

OR THUS, SEE FOREGOING EX.

```
 5.34375
 960268   inverted
 -------
4275000
 320625
  10687
    321
     48
 -------
4.6066 &c. or Sa. R.  4  9  8.4
```

Reduce

Reduce 1331 c. r. 8 a. 10 p., to ficca rupees. Anfwer 1147 fa. r. 14 an. 2 $\frac{96}{116}$ p.

Reduce 10985 c. r. 3 a. 2 p., to ficca rupees. Anfwer 9469 fa. r. 15 an. 11 $\frac{76}{116}$ p.

Reduce 14 an. 6 pa. currency, to ficca. Anfwer 12 an. 6 p.

3.—To reduce Arcot (8 per cent.) rupees, to ficca (16 per cent.) rupees.

*RULE.*—Multiply the given fum by 108, and divide the product by 116, the quotient will be the anfwer.

*EXAMPLES.*

Reduce 589 arcot rupees to ficca rupees.

BY RULE. . . . As 116 . . : . . 108 . . : : . . 589

CONTRACTIONS:

29 . . : . . 27 . . : : . . 589

1.074 . . : . . 1 . . : : . . 589 $\quad 27)\frac{29}{27} = \frac{1.074}{1}$

1 . . : .93103 . . : : . . 589 $\quad 29)\frac{29}{27} = \frac{1}{.93103}$

BY RULE.

```
    589
    108
   ----
   4712
   5890
   ----  Sa.R. a. p.
116)63612 ( 548  6  0  96/106
   580
   ---
    561
    464
    ---
     972
     928
     ---
      44
      16
      --
116)704(6 a.
    696
    ---
      8
     12
     --
116)96(0 96/116 p.
```

OR THUS.

```
    589
     27
   ----
   4123
   1178
   ----  Sa. R. a. p.
29)15903 ( 548  6  0  24/29
   145
   ---
    140
    116
    ---
     243
     232
     ---
      11
      16
      --
29)176(6 a.
   174
   ---
     2
    12
    --
29)24(0 24/29 pa.
```

THUS;

THUS; CONTRACTED. OR THUS.

```
 1.074)589.000                              .93103
     1        589                              589
 ----  ---  sa. RS.                        --------
 1073)598411(548.379 &c.                    837927
      5365         16                      744824
      ----        ----                    465515
       5191     6.064                     -----------
       4292        12                     548.37667
       ----       ----                           16
        8991    .768                           -----
        8584    ----                      6.02672
        ----    sa. r. 548  6  0.72             12
        4070           ----------               ----
Note. see   3219                               0.32064
case 4 in   ----                               ------
division    8510                     sa r. 548 6 0.3 &c.
of deci-    7511                     ----------------
mals.       ----
             9990
             9657
             ----
              333
              ---
```

In 581 a. r. 0 a. 4 p., how many sicca rupees.

```
       BY THE RULE                                   OR THUS
          581   0   4                                 581   0   4
9×12=108            9                       3×9=27             3
        ------------                                ----------
         5229   3   0                                1743   1   0
                   12                                          9
        ------------  sa. r. a. p.                  ----------   sa. r. a. p.
116) 627504  4  0(540 15 2 56/116                29) 15687  9  0( 540  15 2 14/29
     ------                                          -----
rem.  56                                        rem. 14
      --
```

BY DECIMALS.

| CONTRACTED. | | | OR THUS. |
|---|---|---|---|
| 1.074) | 581.0208=0 a. 4 p. | | 581.0208 |
| 1 | 5810208 | | .93103 |
| | | sa. rs. | |
| 1073) | 580439.7792 (540.9504 | | 540.947895 &c. |
| | | or | or |
| See. case 4 in division of decimals. | sa. r. 540 15 2 | | 540 15 1.90 &c. |

In 100 arcot rupees, how many sicca rupees. Answer 93 sa. r. 1 an. 7.86 p.

Reduce 15 an. 3 p. arcot, to sicca. Answer 14 an. 2.37 p.

Reduce 576 a. r. 13 an. 6 p., to sicca rupees. Answer 537 sa. r. 0 a. 11.82 p.

Reduce 1 arcot rupee, to sicca. Answer 14 an. 10.55 p.

4.—To reduce sicca (16 per cent.) rupees to Arcot (8 per cent.) rupees.

*RULE.*—Multiply the given sum 116 and divide the product by 108, and the quotient will be the answer.

*EXAMPLES.*

Reduce 548 sicca rupees to arcot rupees.

BY THE RULE.

548
116

| | | a. r. | a. | p. |
|---|---|---|---|---|
| 108) | 63568 | (588 | 9 | $5\frac{84}{108}$ |

rem. 84

OR THUS.

548
29

| | | a. r. | a. | p. |
|---|---|---|---|---|
| 27) | 15892 | (588 | 9 | $5\frac{21}{27}$ |

Rem. 21

BY

BY DECIMALS.

See, contractions in the foregoing case.

THUS

```
1.074
  548
------
  8592
 42962
537037
------
588.592   or A. R. 588 9 5.7
     16
------
 9.480    See, case 4 in multi-
    12    plication of decimals.
------
 5.764
```

OR THUS. A. R.

```
.93103)548.00000(588.595 or A. R. 588 9 6
Rem. 30715
```

BY PRACTICE.

```
                54800
10 . 1/10     . 5480
 5 . 1/2      . 2740
 1 . 1/5     .. 548
              -------
             9)63568
             -------
        12) 7063 1 9.3
A. R. 588 9 5.7   Ans.
```

Reduce 540 sa. r. 15 an. 3 p. to arcot rupees.

BY GENERAL RULE.

```
                         540   15   3
0×11+6=116                          10
                        ----------------
9×12=108                5409    8   6
                                    11
                        ----------------
                        59504  13   6
                         3245  11   6
                        ----------------
                    9) 62750    9   0
                        ----------------
                   12) 6972     4   6
                        ----------------
               A. R.  581      0   4.5   Ans.
```

OR THUS.

```
                  540   15   3
4×7+1=29                     4
                 --------------
3×9=27.          2163   13   0
                             7
                 --------------
                15146   11   0
                  540   15   3
                 --------------
            3) 15687   10   3
                 --------------
             9) 5229    3   5
                 --------------
       A. R.    581     0   4.5
```

BY

BY DECIMALS.

THUS.

```
           540.9531
                 29
           ----------
3×9=27. 3) 15687.6399
           ----------
        9) 5229.2133
           ----------
A. R. 581.0237 or A. R. 581 0 4.5 Anf.
```

OR THUS; SEE CONTRACTIONS CASE 3.

```
.93103) 540.95310 (581.026 &c.
        rem. 46322      or
Anf. . A. R. 581 0 4.9
```

Reduce 100 ficca rupees, to Arcot rupees. Ans. 107 ar. r. 6 an. 6.2 p.

Reduce 15 an. 3 p. ficca to Arcot. Anfwer 1 a. r. 0 an. 4.55 p.

Reduce 72 fa. r. 9 an. 7 p. to Arcot rupees. Anfwer 77 a. r. 15 an. 7.5 p.

Reduce 1 ficca rupee, to Arcot. Anfwer 1 a. r. 1 an. 2.2 p.

5.—To reduce funnaut (11 per cent.) rupees, to ficca (16 per cent.) rupees.

*RULE.*—Multiply the given fum by 111, and divide the product by 116, the quotient will be the anfwer.

*EXAMPLES.*

Reduce 333 funnaut rupees, to ficca rupees.

```
              As . . . 116 . . . : . . . 111 . . . : : . . 333
CONTRACTIONS { Or . . 1.045 . . . : . . .   1 . . . : : . . 333   111) 116/111 = 1.045/1
              { Or . . .   1 . . . : . .95689 . . . : : . . 333   116) 116/111 = 1/.95689
```

BY RULE.

```
      333
      111
      ——Sa.R. a. p.
116)36963 (318 10 3 32/116
    348
    ———
    216
    116
    ———
    1003
     928
    ———
      75
      16
    ———
116)1200(10
    1160
    ———
      40
      12
    ———
116)480(3 32/116
    348
    ———
     32
```

BY DECIMALS, THUS,

```
1.045) 333.000
   1       333
———— ———————— sa. rs.
1044) 332667 (318.6465 &c.
                or
 rem.  576   318 10 3 &c.
```

See, division of decimals case 4.

OR THUS:

```
          .95689
             333
Sa. Rr 318.64 &c. or Sa. Rs. 318 10 3
```

In 52 sun. r. 3 an. 5 p., how many sicca rupees.

BY GENERAL RULE.

```
   52   3   5
           10×11+1=111
   ———————
   522  2   2
           11
   ———————
  5743  7  10
    52  3   5
  ——————— sa. r.  a.  p.
116)5795 11 3 ( 49  15  4 100/116  Ans.
    ———
    100
```

BY DECIMALS, SEE LAST EXAMPLE.

```
        52.21343
           98659 inverted
        ————————
        46992087
         2610672
          313281
           41771
            4699
        ———————— sa. r. an. p.
Ans. Sa. Rs. 49.962510 or 49  15  4 &c.
```

Reduce 100 sunnaut rupees, to sicca rupees. Answer 95 sa. r. 11 an. 0.4 &c. p.

Reduce 79 sun. r. 15 an. 9 p. to sicca rupees. Answer 76 sa. r. 8 an. 7 p.

EXCHANGE

# EXCHANGE.

CONSISTS in finding the true ſum, PAR PRO PARI, or value for value, of the coin of one country, for that of another.

The par of exchange, is the fixed value of the coin of one country compared with that of another.

The courſe of exchange, is the current price, and is always unſettled, being ſometimes above and ſometimes below par, according to the various circumſtances, and accidents of trade and nations.

Money in the bank of ſome countries is finer and purer than that which is current, the difference in value is called Agio.

As it would be endleſs to treat of every kind of exchange, I ſhall only give the following adapted to Britiſh India.

## MADRAS.

Accounts are kept in ſtar pagodas, fanams, and caſh; alſo, in Arcot rupees, fanams, and caſh; and reckon 80 caſh to one fanam and 12 fanams to one arcot rupee; and 42 fanams to one ſtar pagoda of exchange. The number of fanams to a pagoda, or rupee, fluctuates in the bazar from 36 to 47 according to the real or artificial plenty or ſcarcity of ſilver fanams. Merchants uſually keep their accounts at 45 fanams; and Government at 42 fanams, per ſtar pagodas; and the following examples are computed at the latter rate.

1.—To change rupees into ſtar pagodas.

*RULE.*—Multiply the given ſum, by 100, and divide the product the given rate of exchange; the quotient will be the anſwer.

*EXAMPLES.*

In 500 Arcot rupees, how many ſtar pagodas, exchange at 375 ar. rs. per 100 pagodas.

| | | | | |
|---|---|---|---|---|
| BY THE RULE | AS 375 | : 100 | :: | 500 |
| | 3.75 | : 1 | :: | 500 |
| CONTRACTIONS. | 1. | : .26 | :: | 500 |
| | 75 | : 100 | :: | 1 |

BY THE RULE.

```
      500
       100
      ——— Pag. fan. c.
375)50000(133 . 14 .o Ans.
    375
    ——
    1250
    1125
    ———
     1250
     1125
     ———
      125
       42
      ———
375)5250(14 fan.
      ———
        0
```

BY DECIMALS.

```
          Pag.  .  fan. c.
3·75) 500.00(133·33=14. 0
      ——       42
Rem. 125       —
      ——       66
             1333
             ———
             14.00
              —
```

OR THUS.

```
  .26
   500
  ———
Pag. 133.33 as before.
```

OR THUS Pag.

```
.75)100.00(133.3
     ———
Rem.  25
      —
```

In 500 ar. r. 14 an. 6 p., how many pagodas, exchange at 375 ar. r. per 100 pagodas?

```
   375  :  100   ::   500 14 6
   ——                 ———————    Pag. fan. c.
72000 pa.        720,00)96174,00 pa. (133  24  12  Ans.
                       ———————        ——————————
                   Rem. 114
                         42
                        ———
                  720)17388(24 fan.
                       ———
                       108
                        80
                       ———
                  720(8640(12 c.
                      8640
                      ———
                        0.
```

*N O T E.*—Here I reduce the first and third terms, to pauys.

BY DECIMALS.

```
3·75)50090.625(133·574
     ———————
           0
           —
or pag. 133 24 12
————————
        or
```

I want to draw a Bill of Exchange on Madras for 500 sicca rupees, exchange at 345 Arcot rupees per 100 pagodas, how many pagodas will my agent at Madras debit me for it in account.

First 500 fa. rs. are equal to 537 ar. rs. 0 an. 7 p. See Batta, case 4.

Then 345 . . . : . . . 100 . . . :: . . . 537 0 7

```
      16                    16
      ----                  ----
    5520                  8592
      12                    12
      ----                  ----  Pag. fan. c.
   66240            66240)10311100(155  27 66 Answer.
```

OR THUS.

First, 345 ar. rs. are equal to 321 fa. rs. 3 an. 3.724 p.

Then, 321 3 3.724 . . . : . . . 100 . . . :: . . . 500

```
      16                              16
      ----                            ----
    5139                            8000
      12                              12
      ----                            ----
   61671                           96000
      1000                           1000
   -------                         --------
   61671724                        96000000
                                        100
                                   ---------- Pag. fan. c.
                      61671724)9600000000(155  27  66
```

BY DECIMALS.

```
                Pag.
3.45)53703.64583(156.6627
      or St. Pag. 155 27 65
```

Or as . 321.206896 . : . 100 . :: . 500 . : . 155.665=27 67

In 10000 current rupees, how many star pagodas; exchange at 390 c. rs. per pagoda.

Answer 2564 st. pag. 4 fan 24 $\frac{24}{39}$ c.

In 557 sicca rupees, how many star pagodas, exchange at 379 current rupees per 100 pagodas. Answer 170 st. pag. 26 fan. 13.5 c.

2.—To change star pagodas into rupees.

*RULE.*—Multiply the given sum, by the rate of exchange, and divide by 100.

*EXAMPLES.*

In 133 st. pag. 24 fan. 12 c., how many Arcot rupees; exchange at 375 Arcot rupees per 100 pagodas;

100

```
100 . . . . . . . . 375 . . . . . . . . 133  24  12
 42                                      42
----                                     ---
4200                                    5610
  80                                      80
------                                  ------
336000                                  448812
                                           375
                                        ------  A.R.  a. p.
                          3360,00)1683045,00 (500  14  6 Answer.
                          ------------------  ---------
                                  Rem. 3045
                                         16
                                       ----
                               336,0)48720,0(14 an.
                                       ----
                                        168
BY DECIMALS.                             12
           fan. c.                      ---
133.575=24  12                    336)2016  6 p.
  3.75                                2016
--------                              ----
Pag. 500.90625 or 14 a. 6 p.             0
```

In 7000 star pagodas, how many sicca rupees, exchange at 379 Arcot rupees per 100 pagodas? Answer 24700 sa. r. 7 an. 6 p.

Imported goods into Calcutta, amounting per invoice to 5004 st. pag. 15 fan. 40 c.; reduce them into sicca rupees, at the rate of $3\frac{1}{4}$ sa. rs. per pagoda, in order to regulate the duties at the Custom-house. Answer 18766 sa. r. 4 an. 8 p.

---

## BOMBAY.

Accounts are kept in Rupees, quarters, and reas, reckoning 100 reas to one quarter, and 4 quarters or 400 reas to one rupee.

100 Bombay (soortee) rupees are equal to 110 current rupees.

3.—To change Bengal, into Bombay Rupees.

*RULE.*—Multiply the given sum by 100, and divide the product by the rate of exchange: the quotient is the answer.

*EXAMPLES.*

In 5000 current rupees, how many Bombay rupees, exchange at 116 current rupees per 100 Bombay rupees?

5000

5000
100

116)500000(4310 1 37 Anſ. (B. R. QR. REAS.)

rem. 40
400

116)16000)1 37 (qr. reas.)

rem. 108

OR THUS. B. R.
1.16)500000.00(4310.344=1 37

rem. 96

Bengal remits to Bombay 500 cur. rs. 14 a. 6 p., exchange at 124 current rupees per 100 Bombay rupees, how much will Bengal be credited for it at Bombay?

As 124 . . : . . 100 . . :: . . 500 14 6
16 — 16
1984 — 8014
12 — 12
23808 — 23808)9617400 ( 403 3 82 Anſwer. (B.R. qrs. reas.)

Rem. 22776
400

23808)9110400 ( 3 82 (qrs. reas.)

15774

OR THUS. B. R.
1.24)500.90625 (403.956

Rem. 81

OR
B. R. 403 3 82

Change 500 ſicca rupees, into Bombay rupees exchange 115 current rupees per 100 Bombay rupees.

First, 500 ſa. rs. are equal to 580 current rs. See Batta caſe 1. and Madras Exchange caſe 1. Ex. 3.

Then, as 115 c. r. : is to 100 B. r. : : ſo is 580 c. r. : to B. r. 504 1 39 Anſ.

Or thus, as 115 . . : . . . 116 . . . : : . . . 500 . . . : . . B. r. 504 1 39

In 1515 current rupees, how many Bombay rupees, exchange at 110 current rupees per 100 Bombay rupees. Anſ. 1377 B. r. 1 qr. 9 reas.

In 100 ſicca rupees, how many Bombay rupees, at 110 current rupees per 100 Bombay rupees. Anſ. 105 B. r. 1 qr. 81 reas.

## 4.—To change Bombay into Bengal rupees.

RULE

*RULE.*—Multiply the given sum, by the rate of exchange, and divide the product by 100, the quotient will be the answer.

In 5000 Bombay rupees, how many current rupees, exchange at 116 current rupees per 100 Bombay rupees.

```
          116
         5000
        ------
C. Rs. 5800.00
```

In 403 B. r. 3 qrs. 82 reas, how many current rupees exchange at 124 current rupees per 100 Bombay rupees.

```
100 . . . : . . . 124 . . . :: . . . 403  3  82
 400                                 400
-----                               -----
40000                               161582
                                       124
                                    ------ C. R.  a.  p.
                         40000)20036168 (500  14  5 Ans.
                                    ------
                              Rem. 36168
                                      16
                                    ------
                         40000)578688(14 an.
                                    ------
                              Rem. 18688
                                      12
                                    ------
                         40000)224256(5 p.
                                    ------
                              Rem. 24256
```

OR THUS.

```
              qrs. reas.
403.955=3  82
   12.4
  -------
C. R. 500.9042=14 a. 5 p.
```

In 504 Bom. r. 1 qr. 31 reas, how many sicca rupees, exchange at 115 current rupees per 100 Bombay rupees.

```
   B.R.     C.R.     B.R. qr. reas.    C.R. A. P. SA. R. A. P.
As 100 . : . 115 . : . 504 1  31 . : . 579 15 7 or 499 15 8, see Batta case 2.
```

OR THUS, BY GENERAL RULE IN BATTA.

```
116 . :: 115 : : . 504.3275 : SA. R. 499  15  8
```

OR THUS.

```
504.3275
    1.15
--------
C. r. 579.976625=15 a. 7 p. or sa. r. 499 15. 8 Answer.
```

In

In 100 Bombay rupees, how many ficca rupees, exchange at 110 current rupees per 100 Bombay rupees. Anf. Sa. Rs. 94 13 2.895.

In 55 Bombay rupees, 3 qrs. 50 reas how many ficca rupees, at 102 Bombay rupees per 100 ficca rupees. Sa. Rs. 54 12 5.56.

## CHINA, MANILLA, &c.

### To change Bengal currency into Spanifh Dollars.

*RULE.*—Multiply the given fum, by the rate of exchange, and divide the product by 100; the quotient is the anfwer.

34 Marvadies make one Rial,
8 Rials —— —— Spanifh Dollar.

*EXAMPLES.*

Bengal remits to China 1000 current rupees; exchange at 41 Spanifh dollars per 100 current rupees; what will this remittance amount to at China in Spanifh dollars?

```
        1000
        41

1,00) 10,00

Sp. Dol. 410  Anf.
```

Bengal remits to Manilla 565 cur. rs. 8 an., exchange at 41½ Spanifh dollars per 100 current rupees.

| C. R. | | S. D. | | C. R. | A. |
|---|---|---|---|---|---|
| 100 | : | $41\frac{1}{2}$ | : | 565 | 8 |
| 16 | | | | 16 | |
| 1600 | | | | 9048 | |
| | | | | $41\frac{1}{2}$ | |
| | | | | 370968 | |
| | | | $\frac{1}{2}$ . . . . | 4524 | |

S. D. R. MAR.
1600)375492( 234 5 15
rem. 1092
8
1600)8736(5 rials.
rem. 736
34
1600)25024(15 marvadies.
1024

OR THUS.
565.5
.415
S. D. 234.6825 or S. D. r. m. 234 3 15

In 576 current rupees, how many Spanish dollars, exchange at 43 Spanish dollars per 100 current rupees. Anf. Sp. Dr. 247 5 14 .96

In 720 cur. r. 13 an. 4 p. how many Sp. dollars, at $42\frac{1}{2}$ Spanish dollars per 100 current rupees. Anf. 306 2 28.3

To change Spanish dollars into Bengal currency.

*RULE.*—When the exchange is in dollars, multiply the given sum by 100, and divide the product by the rate of exchange; the quotient will be the answer.

When the exchange is in rupees, multiply the given sum by the rate of exchange, and divide the product by 100; the quotient is the answer.

*EXAMPLES.*

China draws upon Bengal for 410 Spanish dollars, exchange at 41 Spanish dollars per 100 current rupees; how many current rupees will pay the bill.

410
100
41)41000
C.R. 1000 Ans.

China

China draws upon Bengal for 410 Spanish dollars, exchange at 243 current rupees per 100 Spanish dollars; how many current rupees will pay the bill.

```
           410
           243
           ---  C.R. A. P.
100)996,30(996  4  9.6 Ans.
            16  --------
            --
     an.  4,80
            12
            --
      p.  9,60
            --
```

Manilla draws on Bengal for 50000 Spanish dollars, 7 rials, [illegible]ervadies exchange at 230 current rupees per 100 Spanish dollars; how many current rupees, will pay the draft.
Answer 115002 cur. r. 1 an. 0.2 pa.

In 555 Spanish dollars how many sicca rupees, exchange at 42 Spanish dollars per 100 current rupees. Answer sa. r. 1139 2 6.

---

## ENGLAND.

Accounts are kept in pounds, shillings, pence and farthings reckoning, 4 farthings to one penny; 12 pence to one shilling; and 20 shillings to one pound sterling, which is an imaginary coin.

To change pounds sterling into rupees; Pagodas; &c.

*RULE.*—Divide the given sum, by the rate of exchange: the quotient is the answer.

*EXAMPLES.*

In 11 £. 13 s. 4 d. how many sicca rupees, exchange at 2 s. 4 d. per sicca rupee,

```
    s. d.    sa. r.      £.  s. d.              OR THUS.
As  2  4  :   1    ::   11  13  4          s. d.
   12                   20                 2  4=.116)11.666
   --                   ---                          11  1166
   28                   233                          --  ----
                        12                         105) 10500
                        --- sa. r.                      -----
                 28)2800 (100 Answer.          Ans. sa. r. 100
                    ----  ---                              ---
                       0
                      --
```

See, division of decimals case 4.

In

In 40 pounds sterling, how many star pagodas, exchange at 8 shillings per star Pagoda?

```
     s.    pag.    £.          s.  OR THUS.
As 8  :  1  ::  40           8=.4)40.0
                20           ---------
               ----          st.pag. 100 Ans.
              8)800                  ---
              -----
Ans. st. pag.  100
               ---
```

In 12 £. 10 s., how many Bombay rupees, exchange at 2 s. 6 d. per rupee.
Answer 100 Bombay rupees.

In 37 £. 18 s. 4 d., how many China tales at 7 s. 7 d. per tale?
Answer 100 tales.

In 11 £. 5 s., how many current rupees, exchange at 2 s. 3 d. per rupee.
Answer 100 current rupees.

In 57865 £. 15 s. 6¼ d., how many rupees, exchange at 2 s. 1 d. per rupee.
Answer Rs. 556471 7 6.24.

In 559 pounds sterling, how many rupees at 2 s. 0½d per rupee.
Answer sa rs. 5475 14 8.32.

In 777 pounds sterling, how many pagodas, exchange at 7 s. 9 d. per pagoda.
Answer pag. 2005 6 62.

## To change rupees; pagodas; &c. into pounds sterling.

*RULE.*—Multiply the given sum by the rate of exchange, and the product is the answer.

### *EXAMPLES.*

In 100 sicca rupees, how many pounds sterling, exchange at 2 s. 4 d. per sicca rupee.

BY PRACTICE.

```
s.  d. far.              THUS.              OR THUS.
2   4.  100               100               s.
12       28                 2               2 .. 1/10  100
--      ---              ----                          ---
28 12)2800 d.      d.     200               d.
      ------                                4    1/6    10
   20)233  4       4 .. 1/6  33  4                  ----------
      --------             --------                  1 13 4
Ans. £. 11 13 4         20)233  4                  ----------
        -------            --------             £. 11 13 4 Ans.
                       £. 11 13  4 Ans.            ----------
                          ---------
```

In 544 cur. rs. 4 a. 6 p., how many pounds sterling, exchange at 2 s. 3 d. per current rupee.

```
c.r.       s. d.        c. r.  a.  p.
  1    :   2  3    ::    544   4   6
 16       12              16
 --       --            ----
 16       27            8708
 12                       12
 --                    -----
192                   104502
                          27
                      ------       D.
             192)2821554( 12 )14695 1/2
                 ------      --------
             Rem. 114(20)  1224 7
                    4      ------
                  ---     £. 61 4.7 1/2 Ans.
             192)456(1/2
                 394
                 ---
             Rem. 62
                 ---
```

BY PRACTICE.

```
                  598   4   6
                  -----------
2 s. . . . 1/10    54   8   0
3 d.       1/8      6  16   0
4 an.      1/4              6 1/4
6 p.       1/8                1/4.37 &c.
                 -------------------
               £. 61    4   7 1/2.37 Ans.
```

BY DECIMALS.

```
       544.28125=4   6
          .1125
          ------
 £. 61.231640625
          20
        ----
   s. 4.63
        12
        --
   a. 7.56
         4
        --
   f. 2.2 &c. or £. 61 4 7 1/2 &c.
```

In 55799 cur. rs., how many pounds exchange at 2 s. 0 1/4 per rupee.
Answer £. 5754 5 5 1/4.

In 555 pagodas, how many pounds sterling, exchange at 8 s. per pagoda.
Answer £. 222 0 0.

SIMPLE.

# SIMPLE INTEREST.

IS a profit allowed by the Borrower to the Lender, for the loan of any fum of money, for any fpace of time, and at any rate per centum per annum, (that is, for 100 for one year) agreed upon: the extremity of the rate or LEGAL intereft, that can be taken in Great Britain is 5 per cent. per ann., but if a contract which bears intereft be made in a foreign country, Britifh Courts of Judicature will direct the payment of intereft, according to the Law of that country in which the contract was made.

In Bengal the LEGAL intereft extends to 12 per cent. per ann.

Any perfon refiding in GREAT BRITAIN, who receives a higher rate of intereft than 5 per cent. per ann.; or, any Britifh fubject refiding in Bengal who may receive a higher rate of intereft than 12 per cent. per ann, either directly or indirectly, commits ufury, and is liable to be profecuted accordingly, and on conviction to pay, three times the principal or money lent, on which exceffive intereft was charged and paid, half of which, in Great Britain goes to the King, but in India, to the Eaft India Company, and the other half to the profecutor or informer, alfo, treble cofts of fuit.

In the folution of queftions in fimple intereft, four things are to be confidered, viz.

1.—The principal, or money lent.

2.—The time, for which it is lent.

3.—The rate per cent. per ann.

4.—The amount, being the principal and intereft together.

Any three of thefe being given, to find the fourth.

There are various methods of computing fimple intereft, which are all deduced from compound proportion, or the rule of five.

---

## GENERAL RULES.

There are five numbers given to find a fixth proportional, which may be anfwered by two fucceffive ftatings or operations in the rule of three,

but

but more expeditiously as follows, or by the directions given in the rule of five, to which refer.

Of the given numbers, three are a supposition, and the other two a demand; therefore, of the three terms in the supposition, let that which is the principal cause of gain or loss, be put for the first term; that number which denotes time be put for the second term; then place the other two terms of the demand, in the same order as the preceding.

THEN

1.—If the term sought be of the same name with the first or second term, multiply the first, second, and fifth terms continually for a dividend, and the other two for a divisor; the quotient arising therefrom will be the sixth proportional.

2.—But if the term sought be of the same name with the third, the continued product of the three last terms, divided by the product of the first two, will quote the sixth proportional.

*CASE* 1.—The principal, time, and rate per cent. per an. given; to find the interest.

*SECTION* 1.—When the given time is in years.

*RULE* 1.—Multiply the principal, by the rate, that product divided by 100, will give the interest for one year, which multiplied by the given number of years, gives the interest required.

2.—Divide the given sum, by the aliquot parts of 100 with the rate, and multiply the quotient by the given number of years, as before.

BY DECIMALS.

3.—Multiply the principal, by the ratio, and that product multiplied by the time, will give the interest.

The ratio is the simple interest of 1 rupee, pagoda, &c. for one year at any given rate, and is thus found: Let it be required to find the ratio of 12 per cent.

As 100 : 12 :: 1
12

100)12,00(.12
1200

An

And in this manner the ratios in the following Table are found.

## TABLE OF RATIOS.

| RATES. | RATIOS. | RATES. | RATIOS. |
|---|---|---|---|
| 3 | .03 | 6 | .06 |
| 3½ | .035 | 7 | .07 |
| 3¾ | .0375 | 8 | .08 |
| 4 | .04 | 9 | .09 |
| 4¼ | .0425 | 10 | .10 |
| 4½ | .045 | 11 | .11 |
| 5 | .05 | 12 | .12 |

### *EXAMPLES.*

What is the interest of 265 rupees, 10 an. 8 p., for 6¼ years at 12 per cent. per annum.

BY GENERAL RULE 2.

```
        r.     yr.       r.                 r.   an.  p.             yrs.
If     100  in  1  gains  12  what will    265   10   8  gain in  6¼
                                                      12
                                          ---------------
                                          3188    0    0
                                                      6¼
                                          ---------------
                                         19128    0    0
              ½ ...... ½ ...              1594    0    0
              ¼ ...... ½ ...               797    0    0
                                          ---------------
                                     100)21519    0    0
                                          ---------------
                                  Rs.      215    3   0.48  Answer.
```

BY RULE I.

```
       265  10    8      Principal
            12           Rate
       -------------
100)  3188   0    0
       -------------
        31  14  0.96     Int. for 1 year
                  6      years
       -------------
       191   4  5.76     Int. for 6 years
¼ .. ⅛  23  14  6.72     ..... for ¼
       -------------
Rs.    215   3  0.48     Answer.
```

BY RULE II.

```
            265  10    8
            -------------
10  1/10     26   9   0.8
              5   5   0.16
            -------------
 2  1/5      31  14   0.96
                      6
            -------------
            191   4   5.76
¼ ... ⅛      23  14   6.72
            -------------
Rs.         215   3   0.48  Ans.
```

BY RULE 3.

265.6=10 a. 8 p.
12 ratio

31.880 Int. for 1 year
6.75=6¼ years

159400
223160
191280

R. 2115.19 or R. 215 3 0.48 Anſ.

What is the intereſt of 525 r. 8 a. 6 p. for 8 years, at 12 per cent. per ann.
Anſ. 504 r. 8 a. 1.92 p.

What is the intereſt of 2870 ſt. pag. 22 fan. 40 c. at 8 per cent. per ann. for 6 years.
Anſ. ſt. pag. 1377 37 64.

What is the intereſt of 856 Bom. r. 1 qr. 50 reas, for 10 years, at 9 per cent. per ann.
Anſ. 770 r. 2 qrs. 95 reas.

What is the intereſt on 725 £. 10 s. 6 d. for 5 years, at 5 per cent. per annum.
Anſ. 181 £. 7 s. 7½ d

*SECTION* 2.—When the given time is in weeks.

*RULE* 4.—Find the intereſt of the given ſum for one year by rule 1; then multiply that intereſt by the given number of weeks and divide the product by 52 weeks in a year.

5.—Divide the intereſt of the given ſum for one year, by the aliquot parts of a year, that is, 52 weeks; with the given number of weeks, by the rule of practice.

*EXAMPLES.*

What is the intereſt of 565 r. 8 an. 6. p. for 32 weeks, 8 per cent. per ann.

BY

BY GENERAL RULE 2.

```
   r.  wks.       r.             r.  a. p.        wks.
If 100 in 52 gains 8 what will 565  8  6 gain in 32
    52                                 4×8=32
   ----                        -----------
   5200                        2262  2  0
                                        8
                               -----------
                              18097  0  0
                                        8
                              ----------- r.  a. p.
                   52[00)1447[76  0  0(27 13 5  Ans.
                         104
                         ---
                         407
                         364
                         ---
                   Rem. 4376
                          16
                        ----
                   5200)70016(13
                        -----
                   Rem. 2416
                          12
                        ----
                   5200(28992(5
                        -----
                   Rem. 2992
                        ----
```

BY RULE 4.

```
     565  8  6
             8
    ----------
100)4524  4  0
    ----------
      45  3  10.56  Int. for 1 year.
                  4×8=32 wks.
      ------------
     180 15   6.24
              8
     -------------
  52)1447 12  1.92
     -------------
Ans. R. 27 13  5.5
```

BY RULE 5.

```
                  45   3  10.56  Int. for 1 year
Weeks             ------------
 26     1/2       22   9  11.28
  4     1/13       3   7   8.19
  2     1/2        1  11  10.09
                  ------------
            Rs.   27  13   5.5  Answer.
```

BY RULE 3.

```
565.53125=8 a. 6 p.
      .08 Ratio.
-----------
45.2425...
.61538=32 weeks
-----------
Ans. R. 27.8413 or R. 27 13 5.5
```

What

What is the intereſt on 378 ſa. r. 4 a. 3 p. for 35 weeks, at 12 per cent. per ann.
Anſ. 30 r. 8 a. 10 p.

What is the intereſt of 1276 pag. 10 fan. 60 c. for 48 weeks, at 8 per cent. per ann.
Anſ. 94 pag. 11 fan. 3.2 c.

What is the intereſt of 5885 Bom. rs. 1 qr. 80 reas, for 20 weeks, at 9 per cent. per ann.
Anſ. 203 r. 2 qr. 90 c.

What is the intereſt on 500 £. for 26 weeks, at 5 per cent. per ann. Anſ. 12 £. 10 s.

*SECTION* 3.—When the given time is for months.

*RULE* 6.—Find the intereſt of the given ſum, for one year; then multiply that intereſt by the given number of months, and divide the product by 12, months in a year.

7.—Divide the intereſt of the given ſum for one year, by the aliquot parts of a year, that is, 12 months; with the given number of months, according to the rule of practice.

8.—When the given rate is 12 per cent. per ann. divide the principal by 100, then multiply the quotient by the number of months given.

*EXAMPLES.*

What is the intereſt of 500 rs. 8 an. for 9 months, at 12 per cent. per ann.

BY GENERAL RULE 2.

```
    r.   mo.       r.          r.   an.        mo.
If 100 in 12 gains 12 what will 500  8 gain in 9.
    12                               9
    --                          --------
  1200                          4504  8
                                     12
                             ----------  r.
                     1200)54054    0(45  0  8 Anſ.

                     Rem. 54
                          16
                          --
                         864
                          12
                         ---
                   1200)10368(8
                         9600
                        -----
                   Rem.  768
```

BY RULE 6.

```
        500   8
             12
      --------
100)  6006
      --------
        60   0   11.52  Int. for one year
                     9  Months
      --------------------
12)    540   8    7.68
      --------------------
Rs.     45   0    8.64  Answer
```

BY RULE 3.

```
   500.5=8 an.
     .75=9 months
   ------
 375.375
     .12  ratio.
   ------
R. 45.045  or  R.  45  0  8.64
```

BY RULE 7.

```
            60   0   11.52  Int. for 1 year
          -------------------
6   1/2     30   0    5.76
3   1/2     15   0    2.88
          -------------------
Rs.         45   0    8.64  Answer.
```

BY RULE 8.

```
100)  500   8
      -----
        5   0   0.96 Int. for 1 month.
                   9
      ----------------
Rs.    45   0   8.64  Answer.
```

What is the Interest of 750 rupees for 5 months, at 6 per cent. per annum.
Answer Rs. 18 12 0.

What is the Interest of 500 Pagodas, for 7 months, at 8 per cent. per annum.
Answer Pag. 23 15 0.

What is the Interest of 776 Bom. rupees, for 11 months, at 9 per cent. per annum.
Answer By. Rs. 64 0 08.

What is the Interest of 357 pounds sterling, for 3 months, at 3½ per cent. per annum.
Answer £. 3 2 5½.

*SECTION* 4.—When the given time is in days.

*RULE* 9.—Find the interest of the principal for one year, by rule ; then, multiply that interest, by the number of days given, and divide the product by 365 days in a year.

10.—When convenient, divide the interest of the principal for one year, by the aliquot parts of a year, or 365 days, with the given number of days, according to the rule of practice.

11.—Multiply the principal by the given number of days, for a dividend ; then, multiply 365 by 100, and divide the product by 5, the quotient,

quotient will be 7300 for a divifor; divide the dividend by that divifor, the quotient will give the intereft at the rate of 5 per cent. laftly, multiply that quotient by the given rate and divide the product by 5; which will be the anfwer required.

BY DECIMALS.

12.—Multiply the principal, ratio and time continually; the product will be the anfwer.

13.—Multiply the Intereft of one rupee for one day, at the given rate, by the principal and number of days; the product will be the anfwer.

THE INTEREST FOR ONE DAY IS FOUND THUS:

As 365 days : are to the ratio : : fo is 1 : to the intereft of 1 rupee for 1 day.

| RATES. | INT. FOR ONE DAY. | RATES. | INTEREST FOR ONE DAY. |
|---|---|---|---|
| 1 per cent. | .0000273972 | 9 per cent. | 0002465753 |
| 6 ——.— | .0001643835 | 10 ——— | 0002739726 |
| 8 ——.— | .0002191780 | 12 ——— | 0003287671 |

14.—Multiply the principal by the given number of days for a dividend; then multiply 365 by 100, and divide the product by the rate per cent. for a divifor; divide the dividend by that divifor, the quotient will be the intereft required.

## TABLE OF DIVISORS,

*AT 365 DAYS TO A YEAR.*

| | | | |
|---|---|---|---|
| 1 per cent. | 36500 | 9 per cent. | 4055.5 |
| 5 ——— | 7300 | 10 ——— | 3650 |
| 6 ——.— | 6083.3 | 12 ——— | 3041.6 |
| 8 ——.— | 4562.5 | | |

EXAMPLES.

### EXAMPLES.

What is the intereſt of 542 r. 15 an. 3 p. for 125 days, at 12 per cent. per annum.

BY GENERAL RULE 2.

```
   R.    DAYS.        R.             R.    A.  P.          DAYS.
If 100 in 365 gains 12 what will 542 . 15  3 gain in 125
   365                                     10×12×5=125
   -----                         -------------
   36500                          5429   8  6
   -----                                   12
                                 -------------
                                 65154   6  0
                                  2714  12  3
                                 -------------
                                 67869   2  3
                                           12
                                 -------------  r.  a. p.
                          36500) 814429  11  0 (22  5  0 Anſwer.
                                 -------------  --------
                            rem.  4500
```

This queſtion may be abridged various ways, viz.

```
State reſumed 100 : ... 365    :: .. 12 .. : ... 542 15 3 . :: ...125
                1 : ......1    ::   .12    : ... 542.9531   ::   .342
                1 : 3041.6     ::    1     : ... 542.9531   ::    125
                1 : .. 29.2    ::   .12    : ... 542.9531   ::      1
                                                   .12
                                             -----------
                                 2.92)65.154372(22.313 &c. or Rs. 22 5 0
```

BY RULE 9.

```
       542  15   3
                12
     ---------------
100)6515    7    0
     ---------------
        65  2  5.64
              10×12+5=125
     ---------------
       651  8   8.4
               12
     ---------------
      7818  8   4.8
       325 12   4.2
     ---------------
365)8144    4   9
     ---------------
   R. 22    5  0.12 Answer.
```

See Section 5. Ex. 3

BY RULE 11.

```
        542  15   3
                125
      --------------
7300) 67869  14   3
      --------------
          9   4   9 int. at 5 per 0/0
                 12
      --------------
     5) 111   9   0
      --------------
     R. 22    5   0 Answer.
```

BY RULE 12.

```
542.9531=15 a. 3 p.
   .3425=125 days
-------------
185.9614 &c.
      12 Ratio
-------------
Rs. 22.3153 or Rs. 22  5 0
```

BY RULE 13.

```
Principal ..... 542.9531
Int. for 1 day .0003288
               ---------
                .1785229
Days ..........      125
               ---------
Answer R. 22.3125
          ---------
   Or R. 22  5 0
```

BY RULE 14.

```
              542.9531
                   125
           ------------
3041.6)67869 1375
  3041  6786,1375
       ------------
27375) 61082?2375
       ------------
Answer 22  5 0
```

See, case 4 in division of decimals.

What is the interest of 6826 r. 9 an. 9 p. for 125 days at 12 per cent. per annum. Answer 280 r. 8 an. 8 p.

What is the interest of 6750 pag. 22 fan. 40 c. for 216 days, at 8 per cent. per annum. Answer 319 pag. 26 fan. 27 c.

What is the interest of 8296 Bom. r. 1 qr. 6 reas, for 250 days at 9 per cent. per annum. Ans. Bom. r. 511 1 65.

What is the interest of 399£. 13 s. 4 d. for 4 days at 5 per cent. per annum. Answer 4 s. 4½ d.

*SECTION* 5.—When the given time is in years, months and days.

*RULE* 15.--Find the interest of the given sum, for one year by rule 1, which multiply by the number of years; take aliquot parts with the months,

months, according to rule 7; then find the interest for the days by section 4, of this case,

*EXAMPLES.*

What is the interest of 260 r. 6 a. for 2 years, 4 months and 25 days at 12 per cent. per annum.

| | r. | a. | p. | |
|---|---|---|---|---|
| | 260 | 6 | 0 | Principal |
| | | 12 | | rate |
| 100) | 3124 | 8 | 0 | |
| | 31 | 3 | 11.04 | Int. for 1 year |
| | | | 2 | years |
| | 62 | 7 | 10.08 | Int. for 2 years |
| ) .. $\frac{1}{3}$ | 10 | 6 | 7.68 | 4 mos. |
| | 2 | 2 | 2.89 | 25 days |
| | 75 | 15 | 4.65 | Answer. |

| | Days | r. | a. | p. | Days. |
|---|---|---|---|---|---|
| As | 365 . : . | 31 | 3 | 11.04 . :: . | 25 |
| | | | | | 5×5=25 |
| | | 156 | 3 | 7.20 | |
| | | | | 5 | |
| | 365) | 781 | 2 | 0. | |
| Rs. | | 2 | 2 | 2.89 | Int. for 25 dys. |

It is not accurate in the calculation of interest to take aliquot parts of a month (or 30 days) for days, because the year is not divided into months consisting of the same number of days each, but this method is notwithstanding very commonly adopted in India, thus:

Find the interest for one year by rule 1, then, if the time is given in days, reduce them to months, &c. by dividing by 30; then proceed by taking aliquot parts of a year with the months by rule 7; and of a month or 30 days, with the days.

All the preceding rules in the case, are applicable to this method; reckoning only 360 days, instead of 365 days, to a year and 30 days to a month.

The time between one given date and another, is very commonly reckoned by months and days, for instance; let it be required to find the time from 30th April to 2d September following, thus; from April 30th to May 30th is one month; to June 30th, two months; to July 30th, three months; to August 30th four months; and from that time to Sept. 2d, three days; say, four months and three days.

But properly thus; May 31 days; June 30 days; July 31 days; August 31 days; September 2 days; making together 125 days, which being prepared for computing interest by the foregoing method, make 4 months and 5 days.

The following example, computed by three different methods, will exhibit the difference.

EXAMPLE.

*EXAMPLE.*

What is the interest of 10,000 ficca rupees, from the 30th day of April, to the 2d day of September following, at 8 per cent. per annum.

```
May .... 31          10000                    12)800  0  0 Int. for 1 year
June .... 30             8                    ------------
July .... 31         -----                        66 10  8            1 mo.
August . 31     100)800.00 Int. for 1 year                4 months
September 2            125 days               ------------
          --           ---                   266 10  8 Int. for 4 mo.
    30)125       365)100000            dys.
    ------       ----------            5 .. 1/6   11  1  9            5 days
  4 mo. 5 days.  R. 273 15 6 Anf.             ------------
                                          R. 277 12  5 Anfwer.

                66  10  8 Int. for 1 mo. as before
                         4
                -----------
               266  10  8 Int. for 4 months
3 days. .. 1/10  6  10  8          3 days
                -----------
          Rs. 273   5  4 Anfwer.
```

What is the interest of 542 r. 15 an. 3 p. for 125 days, at 12 per cent. per annum of 360 days.

BY RULE 9.

```
          542  15  3
                   12
        ---------------
100)6515    7   0
        ---------------
          65    2  5.64 Int. for 1 year
                       10×12+5=125.
        ---------------
         651    8  8.40
                   12
        ---------------
        7818    8  4.8
         325   12  4.2
        ---------------
360)8144    4  9
        ---------------
    Rs. 22      9 11.6 Answer.
```

BY RULE 14.

```
        542.9531
             125
        ---------
3000)67.8691375
        ---------
Rs. 22.623, &c. or Rs. 22  9  11.6.
```

See Section 4. Ex. 1.

BY RULE 10.

```
              65   2   5.64
days         ----------------
90 .. 1/4     16   4   7.41
30 .. 1/3      5   6  10.47
5 .. 1/6       0  14   5.74
             ----------------
        Rs.   22   9  11.6 Answer.
```

BY RULE 11.

```
             542  15   3
                     125
            ---------------
7200)67869   14   3
            ---------------
               9   5   9.8
                       12
            ---------------
5)113    1   9.6
            ---------------
      Rs. 22   9  11.5 Answer.
```

BY RULE 8.

```
100)542  15   3
         ---------
       5   6  10.47 Int. for 1 mo.
                 4
         ---------
dys.  21  11   5.88
5 .. 1/6   0  14   5.74
         ---------
   Rs. 22   9  11.6 Answer.
```

*NOTE.*—The interest, added to the principal gives the amount.

When interest is to be calculated, on running cash accounts, or where partial payments are made on account of bonds, bills, notes, &c. bearing interest; multiply the several balances by the number of days, they remain at interest; then multiply the sum or balance by the rate per cent, and divide the product by 36500.

EXAMPLES.

*EXAMPLE.*

MR. J. DAVIS'S INTEREST ACCOUNT at 12 per cent. per annum.

| Date. | | Principal. | | days. | DR. | CR. |
|---|---|---|---|---|---|---|
| 1804 | | R. A. P. | | | | |
| April . 4 | Paid ..... | 600 0 0 | Int. to 12th Ap. | 8 | 4800 | |
| 12 | Received | 89 0 0 | | | | |
| | | 511 0 0 | ..... to 10th May | 28 | 14308 | |
| May . 10 | Received | 940 0 0 | | | | |
| | | 429 0 0 | ..... to 25 ....... | 15 | | 6435 |
| 25 | Paid ..... | 850 0 0 | | | | |
| | | 421 0 0 | ..... to 11th June | 17 | 7157 | |
| Add, bal. of Int. .. . | | 6 8 3 | | | | |
| | | | | | 26265 | 6435 |
| Am. due to J. DAVIS | | 427 8 3 | Deduct ............ | | 6435 | |
| | | | Balance ............ | | 19830 | |
| | | | | | 12 | |
| | | | | 36500) | 237960 | |
| | | | Balance of Int. Rs. | | 6 8 3 | |

*CASE* 2.—When the rate, time, and interest are given, to find the principal.

*RULE* 1.—Multiply the rate by the time, and divide the product by 100, the quotient will be the interest of 1 for the time and at the rate given; then divide the given interest or gain by it; the quotient will be the principal.

2.—Divide the interest, by the product of the ratio and time; the quotient will be the principal.

*EXAMPLES.*

What principal being put to interest for 3 years will gain 54 r. 3 an. 2 p. at 12 per cent. per annum.

BY GENERAL RULE 1.

If 100 ... : ... 1 ... :: ... 12 ... : ... 3 ... :: ... 54 3 2

| | | |
|---|---|---|
| 3 | | 10×10=100 |
| 36 | | 541 15 8 |
| | | 10 |
| | 36) | 5419 12 8 |
| | R. | 150 8 9 Anſwer. |

BY RULE 1.

```
     12                54  3  2
      3                16
    ---                ---
1.00) 36               867
    ---                 12
  0   5  9.12          ---
     12               10406
    ---                 100
     69               -------
    100         6912) 1040600
    ----              -------
   6912             Rs. 150  8  9 Anſ.
```

BY RULE 2.

```
.12
  3                R.
---
.36 (54.1979 (150.549
orR. 150 8 9
```

What principal being put to intereſt for $5\frac{1}{2}$ years, will gain 64 £. 7 s. at 5 per cent. per annum. Anſwer £. 234 0 0

What principal being put to intereſt for 10 years will gain 500 ſicca rupees, at 8 per cent. per annum. Anſwer Sa. Rs. 625 0 0.

What principal being put to intereſt for $5\frac{3}{4}$ years will gain 100 pagodas, at 10 per cent. per annum. Anſwer Pag. 173 41 6.8.

What principal being put to intereſt for 10 years, will gain 72 Bombay rupees, at 9 per cent. per annum. Anſwer Bom. Rs. 80.

*CASE* 3.—When the amount, rate, and time are given, to find the principal.

*RULE* 1.—Multiply the rate by the time, and to the product add 100 for a diviſor; then multiply the given amount by 100, for a dividend; the quotient will be the principal.

2.—Add 1 to the product of the ratio and time; then divide the amount by that ſum; the quotient will be the anſwer.

*EXAMPLES.*

What principal being put out to intereſt, will amount to 204 r. 11 an. 11 p., in 3 years, at 12 per cent. per annum.

BY

```
BY RULE 1.                                    BY RULE 2.
12          204  11  11                       .12
 3                   10                         3
——          ————————————                      ———
36          2047   7   2                      .36
100                   10                       1.
———         ————————————                      ———
136     136)20474   7   8                     1.36)204.74479(150.547 .
                                                   ———————————————
        Rs. 150    8   9  Ans.                  or R. 150  8  9
            ——————————————                            ——————————
```

What principal being put to interest will amount to 500 sicca rupees in 6 ½ years, at 6 per cent. per annum. Answer Sa. Rs. 359 11 4 74.

What principal being put to interest will amount to 500 pounds sterling in 6 ¾ years, at 5 per cent. per annum. Answer £. 373 16 7 ¾.6.

*C A S E* 4.—When the principal, interest, and rate, are given to find the time.

*R U L E* 1.—Find the interest of the principal for one year, by case 1. rule 1; then divide the given interest by it; the quotient will be the answer.

2.—Divide the interest by the product of the principal and ratio; the quotient will be the time.

*E X A M P L E S.*

In what time will 555 r. 6 an. gain 300 rupees, at 12 per cent. per annum.

```
                BY RULE 1.                                 BY RULE 2.
               555   6                                     555.375=6 an.
                    12                                         .12
               ——————                                      ———————
          100)6664   8                                     66.645..)300.000
          ——————————          R.                                    ———————
Int. for 1 year Rs. 66  10   3.84.300                      Ans. yrs. 4 183 days.
                    16              16                               ——————————
                  ————            ————
                  1066            4800
                    12              12
                  ————            ————
             127956+  )       57600000(4 years 183 days Ans.
                              ————————
                       Rem.    641664
                                  365
                              ————————
            127958+  )  234207360(183 days
                        —————————
                  Rem.  43488
                        —————
```

In

In what time will 100 ficca rupees, gain 100 ficca rupees, at 12 per cent. per annum.
Anfwer 8 years 121 days.

In what time will 100 pagodas, gain 100 pagodas, at 10 per cent. per annum.
Anfwer 10 years.

In what time will 100 pounds fterling, gain 100 pounds fterling, at 5 per cent. per annum. Anfwer 20 years.

*CASE* 5.—When the principal intereft and time, are given to find the rate per cent.

*RULE* 1.—Multiply the gain or intereft by 100, and divide the product by the principal; then divide the quotient by the time and that quotient will be the rate per cent.

2.—Divide the intereft, by the product of the principal and time; the quotient will be the rate.

*EXAMPLES.*

At what rate per cent. per annum, will 150 rupees, 8 an. 9 p. gain 54 r. 3 an. 2 p. in 3 years.

BY RULE 1.

```
 150  8  9      54  3  2          150.515 &c.=8 a. 9 p.
  16            16                      3
 ----           ---               ---------
 2408           867               451.638 ) 59.1979 &c.
   12            12                         ----------
 -----          ----              Anfwer  12 per cent.
 28905  )   1040600(3) 36
                       --
     Anfwer.           12 per cent.
```

At what rate per cent. will 100 ficca rupees, gain 100 ficca rupees in 10 years.
Anfwer 10 per cent.

At what rate per cent. will 540 ftar pagodas, gain 100 ftar pagodas, in $3\frac{1}{2}$ years.
Anf. pag. 5.2908 or 5.13 6 .88 per cent.

At what rate per cent. will 100 pounds fterling, gain 100 pounds fterling, in 20 years.
Anfwer 5 per cent.

*NOTE.*—When the principal amount and time are given to find the rate; take the difference between the amount and principal, which is the intereft, then proceed as before.

## DISCOUNT.

Is an allowance made for the payment of any fum of money, before it becomes due, according to a certain rate per cent. agreed on between the parties concerned.

The

The PRESENT WORTH of any ſum or debt, due ſome time hence, is ſuch a ſum as, if put to intereſt for that time, at a certain rate per cent. would amount to the ſum or debt then due.

*RULE* 1.—Find the intereſt of 100 for the time and rate given and add it to 100; then ſay, as that ſum or amount : is to 100 :: ſo is the given ſum or debt : to the preſent worth. Subtract the preſent worth from the given ſum and the remainder is the diſcount.

2.—As the amount of 100 for the given time and rate : is to the intereſt of 100 for that time :: ſo is the given ſum to the diſcount.

3.—As the amount of 1 for the given time and rate : is to 1 :: ſo is the intereſt for the debt for the ſaid time : to the diſcount. Subtract the diſcount from the principal, and the remainder will be the preſent worth.

4.—Add 1 to the product of the ratio and time, and divide the given ſum or debt, by that ſum; the quotient is the preſent worth.

*EXAMPLES.*

What is the diſcount on 500 ſicca rupees, due 73 days, hence, at 12 per cent. per annum.

BY RULE 1.

As 365 : 12 : : 73
73

365)876

2 6 4.8
100 0 0

102 6 4.8

THEN

As 102 6 4.8 : 100 :: 500
16 16

1638 8000
12 12

19660 96000
10 10

196608 960000
100

196608)96000000

Given sum . 500 0 0 R. 488 4 6 Present worth.
Present worth 488 4 6

Discount . R. 11 11 6 Answer.

BY RULE 2.

As 102 6 4.8 : 2 6 4.8 :: 500
16 16 16

1638 38 8000
12 12 12

19660 4608 96000
10 10

196608 960000
4608

196608)4423680000

Answer R. 11 11 6

OR THUS

Rule 1.—As 102.4 : 100 :: 500 : 488.281
2.—As 102.4 : 2.4 :: 500 : 11.756

Rate 12=.12 ; time 73 days=.2
.12×.2+1=1.024 amount of 1 for the given time.
500×.12×.2=12 interest of the debt for the given time.

BY RULE 3.

As 1.024 : 1 12
12

1.024)12.000

Ans. Rs. 11 11 6

BY RULE 4.

.12
.2

.024
1.

1.024)500.000

Present worth . Rs. 448 4 6

What is the discount on 495 r. 12 an., due 2 months 3 days hence, at 12 per cent per annum.

BY

BY RULE I.

```
        12                            As. 102 1 6.937 : 100 :: 496 12 0
mo.                                   Or 19602937)9537600000
2 ,  1/6  2 0 0    Int. for 2 mo.     ----------------------
          0 1 6.937 Int. for 3 dys.      Anf. R. 486 8 7
          -------                             ----------
          2 1 6.937                   Principal ...... 496 12 0
        100 0 0                       Prefent worth . 486  8 7
        ---------                                    ----------
        102 1 6.937                   Difcount .. Rs. 10  3 5 Anfwer
        ---------                                    ------
As 365 : 12 :: 3                               OR THUS.
          3                            102.0986)49675.0000
         --                                   -----------
   365)36                             Prefent worth R. 486 8 7
         --
        0 1 6.937 Int. for 3 dys.
```

What ready money will difcharge a debt of 45000 ficca rupees due 2 years, 9 months, and 25 days hence, at 10 per cent. per annum. Anfwer 35105 8 5 .87.

What is the difcount on £. 210 for 7 months, 6 days, at 5 per cent. per annum.
Anfwer 6 £. 2 s. 3¼.

What is the prefent worth of £. 100 due 12 months hence, at 6 per cent. per annum.
Anfwer 94 £. 6 s. 9½ d.

What is the prefent value of 1 rupee, due 12 months hence, at 12 per cent. per annum.
Anfwer 14 an. 3.428.

It is a common cuftom among thofe who difcount bills, to find the intereft of the principal, from the time the bill is difcounted to the time when it becomes due, including the days of grace, which intereft they take as the difcount, and by that means make it more than it really is; and by the preceding examples it is evident, that he who allows intereft for difcount wrongs himfelf confiderably, for fo much money ought to be paid, as at intereft would amount to the fum due in the time propofed.

It is not illegal to retain the difcount, for it has been adjudged, that intereft may as lawfully be received beforehand for forbearing, as after the term is expired for having forborne: and it fhall not be reckoned merely as a loan of the balance, otherwife every banker, &c. who takes 5l. per cent. for difcounting bills, would be guilty of ufury: for, if upon difcounting a 100l. bill at 5l. per cent. he fhould be conftrued to lend only 95l. then at the end of the time he would receive 5l. intereft for the loan of 95l. principal which is above the legal rate. But this doctrine feems only to apply to negotiable inftruments, and not to bonds.

but

But when goods are bought or sold and discount is to be made for present or prompt payment, at any rate per cent. without regard to time, the interest of the sum as calculated for a year, is the discount.

It is a common practice among many, who deal in discounting bills, to take advantage of the necessitous, by extorting excessive interest in various methods, for they not only deduce interest from the contents of the bill for the time it hath to run, including three days of grace, but extort a premium of 2, 3, 4, &c. per cent. and when the bill becomes due, if the acceptor cannot conveniently pay it, out of mere lenity the bill is renewed and discounted again on the same terms, till the man's eyes are open by paying such an exorbitant rate of interest, for the use of money; there are others who go still more neatly to work in taking advantage of the necessitous; the person who wants money offers his own promissory note for sale or discount at a short date, for instance, if the note be for 100 rupees, the monied man perhaps offers him 80 rupees, more or less, as he can make his bargain, or as he understands, the negociators credit depends, on having the money, and even then, they offer to pay half in money and the remainder in goods at an extraordinary price.

The statute against usury extends to British subjects in India only, not to natives.

The following examples will evince the inevitable ruin which must ensue from borrowing money on such exorbitant terms.

Moses discounted my promissory note for 500 r. dated 1st January, 1803, payable at the expiration of two months from that date at 12 per cent. per annum and took a premium besides of 4 per cent; I renewed it six times on the same terms and then paid it when it became due on the 19th January, 1804; at what rate did I pay per cent. per annum. Note, reckon 3 days of grace on each note, that is, 2 mo. 3 days.

1,00)5,00 Int. per month. 500 As 5,00 : 183 : : 1,00
2 4 Answer R. 36 9 .. 7 per cent.

10 1,00)20.00 premium
3 .. 1/10 0 8 10 8 discount

10 8. discount or Int. 30 8 whole discount.
6 times

183 0

but still more if we consider that the discounting of each note cost 30 rs. 8 an. ready money, excepting the first.

the

The following running interest account is deduced from the foregoing question.

| Date. | | | Principal. | | | | Days. | Interest. |
|---|---|---|---|---|---|---|---|---|
| Jany. | 1 | Received | 469 | 8 | 0 | interest to 4 March | 62 .. | 29729 |
| March | 4 | Paid ..... | 500 | 0 | 0 | | | |
| | | | 30 | 8 | 0 | | | |
| | | Received | 469 | 8 | 0 | | | |
| | | | 439 | 0 | 0 | interest to 7 May .. | 64 .. | 28096 |
| May | 7 | Paid ..... | 500 | 0 | 0 | | | |
| | | | 61 | 0 | 0 | | | |
| | | Received | 469 | 8 | 0 | | | |
| | | | 408 | 8 | 0 | interest to 10 July | 64 .. | 26144 |
| July | 10 | Paid ..... | 500 | 0 | 0 | | | |
| | | | 91 | 8 | 0 | | | |
| | | Received | 469 | 8 | 0 | | | |
| | | | 378 | 0 | 0 | interest to 13 September | 65 .. | 24570 |
| Sept. .. | 13 | Paid | 500 | 0 | 0 | | | |
| | | | 122 | 0 | 0 | | | |
| | | Received | 469 | 8 | 0 | | | |
| | | | 347 | 8 | 0 | interest to 16 November | 64 .. | 22240 |
| Nov. | 16 | Paid ..... | 500 | 0 | 0 | | | |
| | | R. | 152 | 8 | 0 | | | |
| | | Received | 469 | 8 | 0 | | | |
| | | | 317 | 0 | 0 | interest to 19 January .. | 64 .. | 20288 |
| Jan. | 19 | Paid ..... | 500 | 0 | 0 | | | |
| | | | | | | | 383 .. | 151067 |
| | | | 183 | 0 | 0 | | | 12 |
| | | Deduct interest | 49 | 10 | 7 | | | 36500)1812804 |
| | | Balance .... Rs. | 133 | 5 | 5 | | | |
| | | | | | | | Interest Rs. | 49 10 7 |

By the preceding account it is evident, that the proper or legal interest amounts to only 49 r. 10 an. 7 p. and that Moses took 133 r. 5 a. 5 p. more than he was entitled to, making altogether 183 rupees, which is nearly 37 per cent. per annum.

Then

There are numerous very ingenious methods invented by ufurers, for the purpofe of avoiding the ftatute againft ufury, but I believe the foregoing methods do not. I have inferted them as the moft common methods ufed in Bengal, and for the purpofe of elucidating the ruinous confecuences to the borrower and often to the lender.

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## *COMMISSION, BROKERAGE, INSURANCE,*
### AND
## PURCHASING OF STOCKS.

The method of working queftions in thofe rules, or any thing elfe, that is rated at fo much per cent. without regard to time, is the fame as finding the intereft of any fum for one year, by cafe 1, rule 1, in fimple intereft.

COMMISSION is an allowance of fo much per cent. to a factor, &c. for buying and felling goods, for his employer.

BROKERAGE is an allowance of fo much per cent. to a broker, for affifting merchants or factors in procuring, or difpofing of goods, &c.

INSURANCE is an allowance of fo much per cent. given to certain perfons called Underwriters, or to Infurance companies, who engage to make good the lofs of fhips, houfes, or merchandizes which may happen, from ftorms, fire, &c.

PURCHASING and SELLING of STOCKS. STOCKS is the general name for the capitals of our trading companies, and the buying and felling certain fums of money, in thofe funds.

*EXAMPLES.*

What is the commiffion on 500 r. 14 an. 3 p. at 3½ per cent ?

| | | | |
|---|---|---|---|
| | 500 | 34 | 3 |
| | | | 3 |
| | 1502 | 10 | 9 |
| ½ ... ½ | 250 | 7 | 1.5 |
| 100) | 1753 | 1 | 10.5 |
| R. | 17 | 8 | 6 Anf. |

If a broker fells goods to the amount of 1000 £. what is his demand at ⅝ per cent. Anfwer 6 £. 5. s.

What is the premium of infurance on 879 pagodas, at 12½ per cent. Anf pag. 109 39 30.

What is the purchafe of a Government certificate for 10,000, at 6 per cent. difcount. Anf. 9400.

EQUATION

## EQUATION OF PAYMENTS.

Is the finding a time to pay at once, several debts due at different times, so that no loss, shall be sustained by either party.

*NOTE.*—Although the following rule may not be minutely correct, yet the difference between it and other operose methods, is so trifling, that it is always made use of as the most eligible method in business.

*RULE.*—Multiply each payment by the time at which it becomes due. then divide the sum by the products, by the sum of the payments, and the quotient will be the time required.

### *EXAMPLES.*

A. owes B. 190 rupees to be paid as follows: 50 r. at the expiration of 6 months; 60 r. at 7 months; and 80 r. at 10 months; what is the equated time to pay the whole?

50 × 6 = 300
60 × 7 = 420
80 × 10 = 800

190)1520(8 Months. Ans.

A. owes B. 52 r. 7 an. 6 p. to be paid in 4½ months; 80 r. 10 an. to be paid in 3½ months, and 76 r. 2 an. 6 p. to be paid in 6 months; what is the equated time to pay the whole? Answer 4 months 19 days.

A. owes B. £. 100 to be paid in 9 months and £. 500. to be paid in 18 months, what is the equated time to pay the whole. Answer 16 months 15 days.

A debt of 1000 rupees is to be paid as follows, ½ at 8 months; ⅓ in 12 months and the rest in 18 months, what is the equated time to pay the whole. Ans. 11 months.

## COMPOUND INTEREST.

IS an allowance or gratuity made by the borrower to the lender, not only for the use of the principal, but likewise for the use of the interest, after it becomes due, and is therefore called INTEREST upon INTEREST, so that the interest being continually added to the principal at the end of the year, the sum or amount becomes a new principal for the succeeding year, and in this case, the principal and interest always encreasing. The laws of England do not allow money to be lent at compound interest, but the interest may be exacted precisely as it becomes due and lent out again, by which means all the purposes of

compound

compound interest, may be answered to the lender, besides, in purchasing annuities, pensions, or leases in reversion, it is ordinary to allow the purchaser compound interest, for his ready money and therefore every dealer in those articles ought to understand it.

*CASE* 1.—Principal, rate and time given, to find the interest.

*RULE* 1.—To the principal, add the interest for the first year, which becomes a new principal, to which add the interest on it for the next year, which becomes the principal for the third year, proceed thus progressively, for any number of years, and if there are days, add the interest of the last amount for that time; the difference between the given principal and this last amount gives the interest.

2.—Multiply the principal by the amount of one rupee at the given rate for a year, continually for all the years proposed and add for the days, if any, as before.

The amount of one rupee, for one year, at any given rate is found thus:

As 100 : is to the given rate added to 100 : : so is 1 : to the ratio or to the amount of one rupee, for one year, at the given rate.

As 100 : 108 : : 1 : 1.08 the ratio at 8 per cent.
As 100 . 112 : : 1 : 1.12 the ratio at 12 per cent.

*EXAMPLES.*

What will 500 sicca rupees amount to in 3 years and 40 days, at 12 per cent. per annum, compound interest.

1st METHOD.

| | | | | |
|---|---|---|---|---|
| 500 | 0 | 0 | ......... 1st years principal ...... | 500 |
| 60 | 0 | 0 | ................. interest ...... | 60 |
| 560 | 0 | 0 | ......... 2d years principal ...... | 560 |
| 67 | 3 | 2.4 | .............. interest ...... | 67.2 |
| 627 | 3 | 2.4 | ....... 3d years principal ....... | 627.2 |
| 75 | 4 | 2.4 | .............. interest ...... | 75.264 |
| 702 | 7 | 5.088 | ...... 3 years amount ...... | 702.464 |
| 9 | 3 | 9.731 | ...... Int. for 40 days ...... | 9.238 |
| 711 | 11 | 2.829 | ...... Am. for 3 years, 40 days Rs. | 711.702 Answer |
| 500 | 0 | 0 | .......... Principal ............ | 500 |
| 211 | 11 | 2.829 | ...... Compound interest .... Rs. | 211.702=11 an. 2.8 p. |

3d. METHOD.

500 .... Principal
1.12 .... am. of 1 r. for 1 yr.
———
560
1.12
———
627.2
1.12
———
702.464
9.238
———
711.702 Am. for 3 years 40 days.
500.
———
211.702 as before
———

Or thus.

1.12
1.12
———
1.2544
1.12
———
Am. 1 r. for 3 years .... 1.404928
Int. on 1 r. for 40 days .. .018475
———
Am. 1 r. for 3 yrs. 40 dys. .. 1.423403
Multiply by principal ....... 500
———
Answer Rs. 711.7015
or Rs. 711 11 2. &c.
———

What is the compound intereſt on 100 ſicca rupees for 7 years, 96 days, at 10 per cent per annum? Anſwer 100 rupees.

What is the compound intereſt on 10,000 pagodas for 12 years, 25 days at 6 per cent. per annum? Anſwer Pag. 10200.

What is the compound intereſt of 5 Bombay rupees, 2 qrs. for 8 years, 15 days at 9 per cent. per annum? Anſwer 5 R. 2 qrs.

What will 1 ſicca rupee amount to in 6 years, 40 days, at 12 per cent. per annum, compound intereſt? Anſwer R. 2.

*CASE* 2.—The amount, rate and time given, to find the principal or preſent worth.

Divide the given amount, by the amount of 1. at compound intereſt at the rate and for the time given, the quotient is the anſwer.

*EXAMPLES.*

What ready money will clear a debt due 3 years hence of 578 r. 13 an.; compound intereſt being allowed at 5 per cent. per annum?

1.05
1.05
———
1.1025
1.05
———
1.157625 ) 578.812500 ( 500 rupees. Anſ.
578 8,25
———
00

What

What principal or sum of money may be put out to raise the sum of 1000 rupees in 4 years, at 12 per cent. per annum, compound interest? Answer 635 8 3.

What ready money will clear a debt due 6 years and 40 days hence of 1000 sicca rupees, compound interest being allowed, at 12 per cent. per annum?

Answer Sa. Rs. 500.

*CASE* 3.—The principal, amount, and rate, given; to find the time.

*RULE.*—Divide the amount by the principal, and divide the quotient by the amount of 1 for a year, continually, till 1 is the quotient, and the number of divisions gives the number of years.

*EXAMPLES.*

In what time will 500 rupees, amount to 578 r. 13 an. at 5 per cent. per annum compound interest?

500 )578.8125
1.05)1.157625
1.05)1.1025
1.05)1.05
1. Answer 3 years.

In what time will 225 £. amount to 260 £. 9 s. 3¼, at 5 per cent. per annum compound interest? Answer 3 years.

Computations by numbers in compound interest, annuities, pensions, leases, &c. in arrears and in reversion, are in general so very long and operose, and so liable to error, that tables of compound interest, &c. are very useful, if not absolutely necessary to those who are engaged in such negociations, and there are a great variety in publication, but correct tables of logarithms, are the best and easiest to work by.

MONEY doubles itself nearly as follows:

| RATE PER CENT. | SIMPLE INTEREST. years | days. | COMPOUND INTEREST. years | days. |
|---|---|---|---|---|
| 5 | 20 | 0 | 14 | 17 |
| 6 | 16 | 243 | 12 | 325 |
| 8 | 12 | 182 | 9 | 2 |
| 9 | 11 | 40 | 8 | 15 |
| 10 | 10 | 0 | 7 | 96 |
| 12 | 8 | 121 | 6 | 40 |

COMPARISON

# COMPARISON OF WEIGHTS.

IS when the weights of any country, or of different countries, are compared together, and is of great importance to the merchant to be acquainted with.

### 1. BENGAL, &c.

1 ſicca weight is equal to 6.5706 drams, avoirdupois.
80 . . . . . . . . make one Calcutta bazar ſar.
60 . . . . . . . . . . . . . . Serampore ſar.
82 . . . . . . . . . . . . . . Hoogly ſar.
84 . . . . . . . . . . . . . . Benares ſar.
96 . . . . . . . . . . . . . . Allahabad ſar.
84 . . . . . . . . . . . . . . Mirzapoor ſar.
96 . . . . . . . . . . . . . . Lucknow ſar.
72 ſa. wt. 11 an. 2 pn.
10 gund. 3.63 ko. ...... Calcutta factory ſar.

### GENERAL RULE.

Multiply the given weight by the number of ſicca weight in a ſar of that weight; and divide the product by the number of ſicca weight, in a ſar of the required weight.

### *EXAMPLES.*

In 100 factory mons, how many Calcutta bazar mons?

| | ſa. wt. | | ſa. wt. | an | pn. | gun. | ko. | | Fact. mons. |
|---|---|---|---|---|---|---|---|---|---|
| | As 80 | : | 72 | 11 | 2 | 10 | 3.63 | :: | 100 |
| | 80 | : | 72.72 | | | | | :: | 100 |
| CONTRACTIONS. | fact. m. | | baz. m. | | | | | | fact. m. |
| | 11 | : | 10 | | | | | :: | 100 |
| | 1.1 | : | 1 | | | | | :: | 100 |

100
10
11)1000
Anſ. Baz. mons 90 36 5.8

OR THUS.
1.1)100.0
90.90
or B. M. 90 36 5.8 Anſ.

In 540 fac. mn. 15 s. 6 ck; how many bazar mons?
Anſwer 491 baz. mon 10 s. 5.45 ck.

Change 1 mon factory weight; into bazar weight. Anſwer 36 ſrs. 5⅓. cks.

In

In 491 baz. mons. 10 fr. 5.45 cks; how many factory mons.

fa.wt an. pn. gun. ko.

As 72 11 2 10 3.63 : 80 :: 491 10 5.45

CONTRACTED. Or 10 . . . . . . . . : 11 . :: 491 10 5.45

11

10)5043 33 12.

Anf. Fact. mons 540 15 6

In 90 baz. mn. 36 fr. 5.82 ck. how many factory mons? Anfwer 100 fact. mons.

Change 1 far bazar weight into factory weight. Anfwer 1 fr. 1 ck.

Reduce 100 bazar mons, to Lucknow mons. Anfwer L. M. 83 13 5.3.

Reduce 83 mons 13 fr. 5⅓ ck. Lucknow weight; to Calcutta bazar weight. Anfwer Baz. m. 100.

In 56 Hoogly mons; how many Serampore mons? Anfwer S. M. 76 21 5.3.

In 78 mons, Benares weight, how many factory mons? Anfwer F. M. 90 3 9.

In 100 mons Calcutta bazar weight; how many mons, Benares weight. Anfwer Ben. m. 95 9 8.4.

2.—To reduce Calcutta factory weight, to Englifh avoirdupois weight.

1 mon factory weight is equal to 74 lb. 10 oz. 10.6 drams, or 74.6 lb. avoirdupois.

1 mon, 20 fr. or 1.5 mon factory weight is equal to 1 cwt. or 112 lb.

3 mons factory weight, are equal to 2 cwt. or 224 lb.

*R U L E.*—Multiply the given weight by 2 and divide the product by 3, the quotient is the anfwer.

Or, divide the given weight by 1.5, and the quotient is the anfwer.

*EXAMPLES.*

Reduce 5 fact. mons, 20 fr. 8 ck.; to avoirdupois weight.

| | fact. m. | lb. oz. drs. | fact. m. fr. ck. |
|---|---|---|---|
| | As, 1 . . . : | 74 10 10.6 : : ... | 5 20 8 |
| | Or, 1 . . . : | 74.6 . . . . . . : : ... | 5.5125 |
| | 1 m. 20 s. : | 1 cwt. . . : : ... | 5 20 8 |
| CONTRACTIONS. | 1.5 . . . : | 1 cwt. . . : : ... | 5.5125 |
| | | 2 cwt. | 5 20 8 |
| | | 2 cwt. | 5.5125 |

F. m.

```
F. m.      cwt.        F. m. fr. ck.              or thus
As 3 . . : . . 2 . . : . . 5   20   8               5.5125
   40                     40                             2
   —                      —                      ---------
   120                   220                    3) 11.0250
   16                     16                     ---------
   —                     ----                   cwt. 3.675
   1920                  3528                              4
                            2                    ---------
                         ----  cwt. qrs. lb     qrs. 2.70
                                          1150          28
             1920) 7056 ( 3    2    19 ----  Anf.  ------
                                          1920
                   5760    -----------          lb. 19.6
                   ----
                   1296                  Anf. or cwt. 3 2 19.6
                      4                           -----------
                   ----
             1920) 5184 (2 qrs.                  or thus
                   3840                          1.5)5.5125
                   ----                              ------
                   1344                   Anf. cwt.   3.675 as before
                     28
                   ----
                                 1150
            1920) 37632 (19 ---- lb.
                                 1920
                  -----
            Rem.   1150
```

In 56 factory mons, how many cwt? Anf. 37 cwt. 1 qr. 9 lb. 5 oz. 5 dr.

In 59 fact. mons, 10 f. 4 ck. how many pounds avoirdupois? Anf. lb. 4424.

3.—To reduce Calcutta bazar weight, to English avoirdupois weight.

1 mon bazar weight is equal to 82 lb. 2 oz. 2.1$\dot{3}$ drams avoirdupois.

15 mons bazar weight is equal to 11 cwt.

1 $\frac{4}{11}$ or 1.$\dot{3}\dot{6}$ mons bazar weight is equal to 1 cwt. or 112 lb.

*RULE.*—Multiply the given weight by 11 and divide the product by 15, the quotient is the anfwer.

Or, divide the given weight by 1.$\dot{3}\dot{6}$, the quotient will be the anfwer.

Or, multiply the given weight by .7$\dot{3}$, the product will be the anfwer.

EXAMPLES.

*EXAMPLES.*

Reduce 3 mon 10 fr. 4 ck. bazar weight, to avoirdupois weight?

| | Baz. m. | lb. oz. drs. | Baz. m. fr. ck. |
|---|---|---|---|
| As, | 1 | 82 2 2.13 | 3 10 4 |
| Or, | 1 | 82.13 | 3.25625 |
| Contractions | 15 | 11 cwt. | 3 10 4 |
| | 15 | 11 cwt. | 3.25625 |
| | 1.36 | 1 cwt. | 3.25625 |
| | 1 | 73 | 3.25625 |

```
7                         66
--                   ---------
66               9,0) 21491250
--               ---------  cwt. qr. lb.
90                2.387916 or 2  1  15.4 Anf.
```

```
B. m.   cwt.   B. m. fr. ck.
15 . . . 11 . . . . 3  10  4
40              40
--           -------
600             130
16               16
--           -------
9600            2084
                 11
             ------- cwt. qr. lb.
         9600)22924( 2  1  15 Anf.
             19200
             -----
              3724
                 4
             -----
         9600)14896(1 qr.
              9600
             -----
              5296
                28
             -----
         9600)148288(15 lb.
             -----
         Rem. 4288
```

OR THUS.

```
      3.25625
           11
    ---------
  15)35.81875
    ---------
      2.38791
or Cwt. 2 1 15.4 Anf.
```

OR THUS.

```
1.36)3.25625
  1    325625
 --  ---------
135)3.2236875
    ---------
     2.38791
or Cwt. 2 1 15.4 Anf.
```

Reduce 555 mons, bazar weight, to avoirdupois weight. Anf. 407 Cwt.

Reduce 79 mn. 8s. 4ck. bazar wt., to avoirdupo is weight Anf. Cwt. 58-0-9-7-9.

4—

4.—To change English avoirdupois weight, into Calcutta factory weight.

*RULE.*—Multiply the given weight by 3, and divide the product by 2, the quotient will be the answer.

Or, Multiply the given weight by 1.5; the product is the answer.

*EXAMPLES.*

1. Reduce 3 cwt. 2 qrs. 19.6 lb. to factory weight.

| | lb. oz. drms. | | F. mon. | | cwt. qr. lb. |
|---|---|---|---|---|---|
| As | 74 10 10.6 | : .... | 1 .... | :: .... | 3 2 19.6 |
| | 74.6 ........ | : .... | 1 .... | :: .... | 3.675 |
| Contractions | 1 cwt. ........ | : .... | 1 20 . | :: .... | 3 2 19.6 |
| | 1 cwt. ........ | : .... | 1.5 .. | :: .... | 3.675 |
| | 2 cwt. ........ | : .... | 3 .... | :: .... | 3 2 19.6 |

```
     cwt.      mons   cwt. qr. lb.
As . 2    .    3   :   3   2  19.6
     4                 4
    ---               ---
     8                14
    28                28
    ---               ---
   224               411
    10                10
   ----              ----
  2240               4116
                        3
                     ----
               2240)12348
                     ----
  Ans. Fact. mons 5  20  8
```

or thus

```
    3.675               3.675
        3                 1.5
    -----              ------
  2)11.025     F. M. 5.5125
    ------             ------
F. M. 5.5125   or F. M. 5 20 8 Ans.
    ------
or F. mons 5 20 8 Ans.
```

In 575 cwt. 2 qrs. 14 lb. how many factory mons. Ans. F. m. 863 17 8.32

In 1 ton, how many factory mons. Answer F. m. 30 0 0.

5.—To change English avoirdupois weight into Calcutta bazar weight.

*RULE.*—Multiply the given weight by 15, and divide the product by 11; the quotient will be the answer.

Or, divide the given weight by .73, and the quotient will be the answer.

Or,

Or, Multiply the given weight by $1.\dot{3}\dot{6}$ and the product will be the answer.

*EXAMPLES.*

Reduce 2 cwt. 1 qr. 15.4 lb., to Calcutta bazar mons.

| | lb. oz. drms. | | mon. | | cwt. qr. lb. |
|---|---|---|---|---|---|
| | As 82 2 $2.1\dot{3}$ | : | 1 ...... | : : | .... 2 1 15.4 |
| | $82.1\dot{3}$ .. | : | 1 ...... | : : | .... 2.38791 |
| CONTRACTIONS | 11 ..... | : | 15 ..... | : : | .... 2 1 15.4 |
| | 11 ..... | : | $1\dot{5}$ ..... | : : | .... 2.38791 |
| | 1 cwt. | : | $1.\dot{3}\dot{6}$ .. | : : | .... 2.38791 |
| | $.\dot{7}\dot{3}$ .... | : | 1 ...... | : : | .... 2.38791 |

Cwt. mon. Cwt. qr. lb.
11 .... : .... 15 ... : : ... 2 1 15.4

```
  11              2 1 15.4
   4              4
  --              -
  44              9
  28             28
  --             --
 132            267
  10             10
 -----          ----
 12320          2674
                  15
                ----
          12320)40110
                ----
 Anf. Bazar mons 3 10 4
```

OR THUS.

```
      2.38791
           15
     --------
   11)35.81865
     --------
Br. m. 3.25624
or Br. m. 3 10 4  Anfwer.
```

OR THUS.

```
1.36 = 135/99   2.38791
                    135
              ---------
           99)322.36785
              ---------
Baz. m. 3.25624
or Bazar mons 3 10 4 Anf.
```

OR THUS.

```
73)2.38791
 7  238791
--  ------
66)2149119
   -------
```

Anfwer ... B. m. 3.25624 as before.

In 777 cwt. how many bazar mons? Anfwer 1059 21 13.

In 1 ton, how many bags of rice, weighing each 2 bazar mons.
Anfwer 13 bags and 1 m. 10 fr. 14 ck.

6.—

6.—To reduce Calcutta weights to Bombay weights See Tables of Bombay and Surat weights.

1 mon Calcutta bazar weight is equal to 82 lb. 2 oz. 2.13 drms. or 82.13 lb.
1 mon . . . ditto . . . . . . 2 mon, 37 s. 10 p. or 2.93 Bom. wt.
6 bazar mons, 32 fr. 11.63 ck., or 6.81 . 1 Bombay candy of 560 lb.
1 mon Calcutta factory weight . . . 74 lb. 10 oz. 10.6 drs., or 74.6 lb.
1 . . . ditto . . . . . . . . . 2 mon. 26 fr. 20 p. or 2.6 Bom. wt.
7 fact. mons, 20 fr., or 7.5 . . . . . 1 Bombay candy of 560 lb.

*RULE* 1.—As 1 bazar mon : is to 2 Bom. mn. 37 s. 10 p. or 2.93 :: fo is the given weight : to the anfwer in Bombay weight.

2.—As 6 biz. mons; 32 s. 11.63 p. or 6.81 : are to 1 candy :: fo is the given weight : to the anfwer in candys.

3.—As 1 fact. mn. : is to 2 Bom. mn. 26 fr. 20 p., or 2.6 :: fo is the given weight : to the anfwer in Bombay mons.

4.—As 7 fact. mons, 20 s. or 7.5 : are to 1 candy :: fo is the given weight : to the anfwer in candys.

*EXAMPLES.*

Reduce 50 bazar mons, to Bombay mons.

| Br. m. | By. m. | fr. | p. | | RULE 1 | or thus |
|---|---|---|---|---|---|---|
| As 1 .... : .... | 2 | 37 | 10 | .... :: .... | 50 | 2.93 |
| | | | 5×10=50 | | | 50 |
| | 14 | 26 | 20 | | | 146.6 or Bombay mons 146 26 2 |
| | | | 10 | | | 40 |
| Bombay mons | 146 | 26 | 20 Anfwer | | | 26.6 |
| | | | | | | 30 |
| | | | | | | 20.0 |

Or See. General rule in comparifon of Madras weights ; cafe 8.

In 50 bazar mons, how many candies?

Br. m. fr. ck. candy Br. m.
6 32 11.63 : 1 :: 50
40 40
272 2000
16 16
4363 32000
100 100

c. m. f. p.

436363)3200000( 7 6 26 20 Anf.

rem. 145459
20

436363)2909180(6 mons

rem. 291002
40

436363)11640080(26 far

rem. 294642
30

436363)8839260(20 pauys

or thus

6.81)50.00
6 50

can.

675)4950.(7.3 Anf.
20

Rem. 225

mon 6.6
40

fars 26.6
30

pa. 20.0

In 50 factory mons, how many Bombay Mons?

RULE 3.

Fact. mon Bz. m. fr. p. F. m.
As ... 1 .... : .... 2 26 20 .. :: .. 50

5×10=50

13 13 10
10

Bombay mons 133 13 10 Anfwer.

OR THUS.

2.6
50

B.m. fr. p.

133.3 or 133 13 10 Anf.
40

13.3
30

10.0

In 50 mons factory weight, how many candies?

BY RULE 4.

| F.m. | fr. | ck. | | can. | | F. m. |
|---|---|---|---|---|---|---|
| As 7 | 20 | 0 | :: | 1 | :: | 50 |
| 40 | | | | | | 40 |
| 3000 | | | | | | 3,00)20,00 |

Bombay cand, 6 13 13 10 Ans.

7.5)50.0

6.6

or B. C. 6 13 13 10 Answer.

In 59 bazar mon, 10 s. 8 ck. how many Bombay mons? Ans. Bom. m. 173 33 14

Reduce 59 baz. mons, 10 s. 8 ck., to Bombay candies. Ans. Can. 8 13 33 14.

Reduce 59 factory mons, 10 s. 8 ck., to Bombay mons. Ans. Bom. m. 158 1 10.

Reduce 59 fact. mons, 10 s. 8 ck., to Bombay candies. Ans. Can. 7 18 1 10.

7.—To reduce Bombay weights to Calcutta weights.

*RULE* 1.—As 2 Bom. mons, 37 s. 10 p., or 2.93 : are to 1 bazar mon : : so is the given weight ; to the answer in bazar mons.

Or, multiply the given weight by .03409, and the product is the answer.

2.—As 1 candy : is to 6 baz. mons, 32 fr. 11.63 ck. or 6.81 : : so i the given weight : to the answer in bazar mons.

Or, divide the given weight by .146, and the quotient is the answer

3.—As 2 Bom. mons, 26 s. 20 p. or 2.6 : are to 1 factory mon : : so i the given weight : to the answer in factory mons.

Or, multiply the given weight by .0375, and the product is the answer, as before.

4.—As 1 candy ; is to 7 fact. mons, 20 fr., or 7.5 : : so is the give weight : to the answer in factory mons.

Or, divide the given weight by .13.

EXAMPLES

## EXAMPLES.

Reduce 146 Bom. mons, 26 sr. 20 p., to Calcutta bazar mons.

BY RULE 1.

Bm. sr. p. Baz. m. B. m. sr. p.
As 2 . 37 10 : 1 :: 146 26 20
40 40
117 5866
30 30
3520 3520)176000(50 Anf.
17600
0

OR THUS.

2.93 146.66
29 1466
264) 13200(50 Anf.

OR THUS.

146 6 .03409
146 1320
1320 9)449.9
9
49.9 or 50 Anf.

In 7 Bom. can. 6 mn. 26 fr. 20 p., how many bazar mons?

RULE 2.

can. Baz m. sr. ck. c. m. fr.
As 1 ...... : ...... 6 32 11.63 ...... : ...... 7 6 26
20 40 20
20 272 146
40 16 40
800 4363 5866
30 100 30
24000 4.6363 176000
176000
24,000)767998888,000
Bazar mons 49 39 $13\frac{1}{3}$ Anf.

OR THUS.

7.3 6.81
7 66
66 4090
9 4090
9)449.90
49.9 or 50 Anf.

OR THUS.

.146) 7.333
14 733
132) 6600(50 Anfwer.
660

In 133 Bombay mn. 13 sr. 10 p., how many factory mons

RULE 3.

B. m. sr. p. F. m B. m. sr. p.
As 2 26 20 : 1 :: 133 13 10
40 40
106 5333
30 30
3200 32,00)1600,00

Answer Factory mons 50

OR THUS.

2.6) 133.3
2 133
24) 1200
Ans. F. m. 50

OR THUS.

133.3
.0375
6666
93333
400000
F. m. 50 Ans.

In 6 Bom. can. 13 mn. 13 s. 10 p., how many factory mons?

RULE 4.

Can. F.m. sr. Can. m. sr. p.
As 1 7 20 .: 6 13 13 10
20 40 20
20 300 133
40 40
800 5333
30 40
24000 160000
300
24,000)48000,000
4,0)200,0
Ans. Fact. mons 50

or thus

6.6
7.5
333
4666
50. Ans.

or thus

.13)6.66
1 66
12)600
Ans. 50

Reduce 796 Bombay mons, to bazar mons. Ans. Bazar m. 271 14 8 .256

Reduce 50 Bombay candies, to bazar mons. Ans. Bazar m. 340 36 5½

Reduce 150 Bombay mons, to factory mons. Ans. Fy. m. 56 10

Reduce 150 Bombay candies, to factory mons. Ans. Fy. m. 1125

## 8.—To reduce Calcutta weights to Madras weights.

| | lb. | oz. | drms. | |
|---|---|---|---|---|
| 1 Calcutta bazar mon . . . . is equal to | 82 | 2 | 2.13 | avoirdupois, or 82.13 lb. |
| 1 ditto . . factory mon . . . . . . . . . . . . | 74 | 10 | 10.6 | . . . . . . , or 74.6 lb. |
| 1 Madras mon . . . . . . . . . . . . . . . . . | 25 | 0 | 0 | |
| 1 ditto . candy . . . . . . . . . . . . . . . . | 500 | 0 | 0 | |
| 1 ditto . garce . . . . . . . . . . . . . . . . | 9256 | 8 | 0 | . . . . . . , or 9256.5 lb. |

| | Mad. mn. | v. | pol. | p.w. | |
|---|---|---|---|---|---|
| 1 Calcutta bazar mon . . . . is equal to . . . | 3 | 2 | 11 | 3 | or 3.2853 |
| 1 ditto . . factory mon . . . . . . . . . . . . . . | 2 | 7 | 37 | 7.3 | or 2.986 |
| 375 ditto . . bazar mons . . . . . . . . . . . . . . | 1.232 | 0 | 0 | 0 | |
| 75 ditto . . factory mons . . . . . . . . . . . . . | 224 | 0 | 0 | 0 | |

370 Madras mons, 2 vis, 3 pol. 2 p. w. , or 370.26 equal to 1 garce.

| Fac. m. | s. | ck | Fac. mon | |
|---|---|---|---|---|
| 6 | 27 | 3.7 | or 6.69643 . . is equal to . . | 1 Madras candy |
| **Bzr. m.** | **s.** | **ck** | **Bzr. mon** | |
| 6 | 3 | 8.1 | or 6.087 . . . . . . . . . . . . . . | 1 . . . . . ditto. |
| 112 | 28 | 0 | or 112.7 . . . . . . . . . . . . . . . | 1 garce. |
| 1127 | 0 | 0 | . . . . . . . . . . . . . . . . . . . . . . | 10 . . . . . ditto. |

GENERAL RULE.

Reduce the given weight to avoirdupois weight; and divide it by as many pounds, as are equal to 1 or an integer of the required weight.

To reduce bazar mons to Madras mons.

1—As 1 bazar mon : is to 3 Mad. mn. 2 v. 11 pol. 3 p. wt., or 3.2853 ſo is the given weight : to the anſwer.

2.—As 375 bazar mons : is to 1232 Madras mons :: ſo is the given weight : to the anſwer as before. Or divide the given weight, by .30438 and the quotient will be the anſwer.

## *EXAMPLES.*

In 50 bazar mons, how many Madras mons.

BY GENERAL RULE.

```
                 lb. oz. drs.
                 82   2   2.13
                          5×10=50
                 ----------------
                 410  10  10.65
                              10
                 ----------------
As 25 .. : 1 .. : : .. 4106  10  10.5
   16                   16
   ---                 -----
   400                 65706
   16                     16
   ---                 -------
   6400                1051306
     10                     10
   -----               --------   Mad. mn. v. pol. p. w.
   64000              )10513065(   164     2    5    3 Answer
                      ---------
                Rem.  17065
                          8
                      -----
            6,000)136520(2 vis
                 ------
            Rem.  8520
                    40
                 -----
           64000)340800(5 pollam
                 ------
            Rem.. 20800
                     10
                 ------
           64000)208000(3 pag. wt.
                 ------
              Rem. 16000
```

OR THUS.

```
   821.3̇
      50
   -----
25)4106.66̇
   -------
   164.26̇
```

or 164 Mad. mn. 20. 5 pol. 3 p. w.

BY RULE 1.

```
As 1 : 3  2  11  3 :: 50
                  5
      --------------
      16  3  15  5
                 10
      --------------
Mad.mn. 164  2  5  0 Anf.
```

BY RULE 2.

```
As 375 : 1232 :: 50
                 50
             -----
         375)61600
             -----
Anf. Mad. mn. 164  2  5  3
```

or thus
BY RULE I.

3.2853
50
——— Mad. mn. v. pol. p. w.
164.266 or 164 2 5 3 Anf.
8
———
2.13
40
———
5.3
10
———
3.
———

or thus
.30438)50.00000
——— Mad.m. v. pol. p.w.
164.26 &c. or 164 2 5 3

| | M. mn. | v. | p. | p. w. |
|---|---|---|---|---|
| Reduce 5 baz. mns. 2 far. 5 ck., to Madras mons. Anf. | 16 | 4 | 37 | 2 |
| Reduce 10 bazar mons, to Madras mons. Anf. | 32 | 6 | 33 | |

TO REDUCE BAZAR MONS, TO MADRAS CANDIES.

*RULE* 1.—As 6 baz. mons, 3 sr. 8.1 ck. or 6.087 : is to 1 candy :: fo is the given weight : to the Anfwer. Or, multiply the given weight by .16426 and the product is the anfwer.

EXAMPLES.

*EXAMPLES.*

In 50 bazar mons, how many candies?

BY GENERAL RULE.

```
                         lb. oz. drs.                         or thus
                         82  2   2.13                          82.13
                                    5                             50
                        ------------                          -------
                        410  10  10.65                    500) 410.6
                                    10                         -----
                        -------------                          8.213
As 500 . : . 1 . ::     4106  10  10.5           or can. 8 4 2 5 3 as be
   16                     16                             ---------
  ----                  -----
  8000                  65706
  16                       16
 -----                  -----
 128000                 1051306
     10                      10
 -------               --------   can. m. v. pol. p. w.
 1280000               ) 10513065 (  8    4   2    5    3   Ans.
                       ---------    -----------------------
              rem.     273065
                           20
                       -------
         1280000) 5461300 (4 mons.
                  -------
              rem. 341300
                        8
                  --------
        12800,00) 27304,00 (2 vis.
                  -----
              rem. 1704
                     40
                  -----
          1280,0) 6816,0 (5 pol.
                  6400
                  ----
              rem. 416
                    10
                  ----
           128,0) 410,0 (3 p. w.
                  384
                  ---
                   32
                  ---
```

BY ABOVE RULE.

6.0857) 50.000 .16426
 603 50000 50
—— —— can. ——
5479) 450000 (8.213 as before 8.213 as before.

In 25 bazar mons; how many candies? Anfwer 4 c. 2 m. 1 v. 2 p. 6½ p. w.

In 25 bazar mon 20 fr.; how many candies? Anfwer 4 c. 3 m. 6 v. 8 p. 3 p. w.

TO REDUCE FACTORY WEIGHT TO MADRAS MONS.

*RULE* 1.—As 1 factory mon : is to 2 Mad. mons 7 v. 35 pol. 7 3 p. wt. or 2.986 :: fo is the given weight : to the anfwer.

2.—As 75 factory mons : are to 224 Madras mons :: fo is the given weight : to the anfwer as before. Or divide the given weight by .33482 and the quotient will be the anfwer.

*EXAMPLES.*

In 50 factory mons; how many Madras mons?

BY GENERAL RULE.

```
                 lb. oz. drams                              or thus
                 7 4  1 10.66                                74 6
                          5×10=50                              50
                 ————————————                                ————
                 373  5  5.33                             25)373.3
                          10                                 ————
                ——————————————                    Mad. mn.  149.3
As .. 25 .. : 1 .. :: 373  5  5.3                              8
      16           16                                        ——
      ——           ——                                   vis 2.6
     400          5973                                       40
      16            16                                      ————
     ————         ————                                 pol. 26.6
     6400         95573                                      10
       10           10                                    ——————
     ————         ————— Mad. m.  v.  pol.  p. wt.
    64000    )    957333 ( 149   2   26    6.6 Anf.    p. wt.  6.6
                  ——————                                      ——
                                                 Mad. mn. 149 2 26.6
```

BY RULE 1.

| F. m. | M. m. v. pol. p. wt. | F. m. |
|---|---|---|
| As .. 1 .. : .. | 2 7 35 7 33 .. :: .. | 50 |

5 × 10 = 50

14 7 18 6 66
10

Mad. mn. 149 2 26 6.6 Anfwer

OR THUS

2.986
50

Mad. mn. 149.3 as before.

OR THUS

.33482)50.00000

Mad. mn. 149.3 as before
or Mad. mn. 149 2 26 6

BY RULE 2.

| F. m. | M. m. | F. m. |
|---|---|---|
| As .. 75 .. : .. | 224 .. :: 1 .. | 50 |

50

75) 11200

Mad. m. 149 2 26 6 Anfwer.

In 10 factory mons, how many Madras mons. Anf. 29 M. m. 6 v. 37 p. 3⅗ p. w.
In 10 factory mons, 10 fr.; how many Mad. mons. Anf. 30 M. m. 4 v. 36 p. 2.430 p. w.

TO REDUCE FACTORY WEIGHT, TO MADRAS CANDIES.

*RULE.*— As 6 factory mons, 27 f. 3 7 ck. or 6 69643 : are to 1 candy :: fo is the given weight : to the anfwer. Or multiply the given weight by .1493 and the product is the anfwer.

EXAMPLES.

*EXAMPLES.*

In 10 factory mons, how many Madras candies?

BY GENERAL RULE.

```
                 74 10  10.6̇6
                            5
                 ---------------
                 373  5   5.3̇3
                            10
                 ---------------
As 500 : : 1 : 3733  5   5.3̇
   16          16
   --          --
   8000        59733
   16          16
   ----        -----
   128000      955733
       10          10
   ------      -------  can. m. v. pol. p. wt.
   1280000  )  9557333  (  7  9  2  26  6 Ans.
```

OR THUS

```
        74.6̇6
           50
       ------
   500)373.3̇3
       ------
   can. 7.4̇6
           20
       ------
   mn. 9.3̇
         8
       ---
   vis. 2.6̇
          40
       ---
   pol. 26.66
or can. 7 9 2 26 6̇
```

BY ABOVE RULE.

```
6.69643 ) 50.0000
          -------
           7.4̇6  as before
```

```
          .1493̇
             50
          -----
candies  7.4̇6  as before.
```

In 29 factory mons, how many Madras candies? Ans. 3 c. 14 m. 5 v. 13 p. 3 p. wt.

In 25 factory mons, 5 fr. 8 ck. how many candies? Ans. 3 c. 15 m. 2 v. 6 p. 6 p. wt.

TO REDUCE BAZAR MONS TO GARCE.

*RULE* 1.—As 112 bazar mons, 28 fr. or 112.7 : is to 1 garce : so is the given weight : to the answer.

2.—As 1127 bazar mons : is to 10 garce : : so is the given weight to the answer. Or multiply the given weight by .008873 . and the product is the answer.

EXAMPLES.

*EXAMPLES.*

In 500 bazar mons, how many garce.

BY GENERAL RULE.

```
                lb. oz. drs.
                82   2  2.13
                      5 × 10 × 10 = 500
               ---------------
               410  10  10.66
                            10
               ---------------
              4106  10  10 66
                            10
               ---------------
As 9256 8 0 ... : 1 ... : : 41066 10 10.6
     16                         16
   ----                      -----
   148 04                    657065
     16                          16
   ------                   -------
   2369664                  10513005
        10                        10
   -------                  --------
   23696640)105130656(4 123 &c. / 237 &c   or about 4 2/5 garce.
                        10544106
```

OR THUS.

9256.5)41066.6

Anf. Garce 4.43 &c.

or about 4 $\frac{2}{5}$ garce.

BY RULE 2.

```
As 1127   .   10   :   500
                        10
                      ----
              1127)  5000
                      ----
              Anf. 4 2/5
```

OR THUS.

```
     .008873
         500
     -------
Garce 4.4365
```

Reduce 579 bazar mons, to garce. Anfwer 5 garce 11 p.

TO REDUCE MADRAS WEIGHTS TO CALCUTTA WEIGHTS.

| | | | | |
|---|---|---|---|---|
| 1 Madras mon ..... .. | is equal to ..... | Bazar mons ........ | 0 12 2.8 | or .30438 |
| 1232 ditto ............ | ——— ..... | ———— ..... | 375 0 0 | |
| 1 Madras candy ..... | ——— ..... | ———— ........ | 6 3 8.1 | or 6.087 |
| .16426 candy ....... | ——— ..... | ———— ......... | 1 0 0 | |
| 1 Garce .. ............ | ——— ..... | ———— ...... | 112 28 0 | or 112.7 |
| 10 ditto ............... | ——— ..... | ———— .... | 1127 0 0 | |
| .008873 garce ....... | ——— ..... | ———— ......... | 1 0 0 | |
| 1 Madras mon ....... | ——— ..... | Fact. mons ....... | 0 13 6.3 | or .33432 |
| 224 ditto ............ | ——— ..... | ———— ........ | 75 0 0 | |
| 1 Madras candy ..... | ——— ..... | ———— ........ | 26 27 3.7 | or 6.69645 |

GENERAL

GENERAL RULE.

As one of the given weight : is to its weight in avoirdupois : : ſo is the given weight : to its weight in avoirdupois.

Then as 1 of the required weight in avoirdupois : is to 1 :: ſo is the given weight reduced to avoirdupois : to the anſwer.

TO REDUCE MADRAS MONS TO BAZAR MONS.

*RULE* 1.—As 1 Madras mon : is equal to 12 ſars, 2.8 ck. or 39438 bazar weight :: ſo is the given weight : to the anſwer.

2.—As 1232 Madras mons : is to 375 bazar mons :: ſo is the given weight : to the anſwer.

*EXAMPLES.*

Reduce 164 Madras mons, 2 vis., 5 pol. 3 p. wt., to bazar mons.

BY GENERAL RULE.

```
Mad. m. lb.  Mad. m. v. pol. pw.              lb. oz. drs. baz. m.  lb.    oz.
As 1  : 25 : 164     2   5   3     then As 82   2   2.13 : 1 : : 4106   10
   8           8                            16                       16
   —           —                            —                        ——
   8         1314                          1314                     65706
  40           40                           16                       16
  ——         ————                          ————                    ———————
 320        52565                         21026                    1051296
  10           10                           100                       100
 ———        —————                        ———————                  ————————
3200       525653                        2102613                ) 105129600
               25                                                ——————————
           ——————  lb.  oz.                  Anſwer Bazar mons  49 39 15 113/213
3200)13141325(4106  10

Rem. 2125
       16
     ————
3200)32000(10 oz.
     32000
```

OR THUS.

```
As 82.13 : 25 :: 164.26
                      25
                  ——————
                   82133
                  328533
                  ——————
         82.13) 4106.66
            821   41066
         ——————————————
            7392) 369600
                  ——————
Anſwer Bazar mons 50
                  ——
```

BY RULE 1.

Mad. m. far. ck. Mad. m. v pl. pw.
As 1 : 12 2.8 : .: 164 2 5 3

```
 —     16
3200   —        525653
       194        1948
        10
       ——       4205224
       1948     2102612
               4730877
               525653
               ————————
     3200)1023972044( 10)319991
                          16) 31999
                          40) 1999  15
                      B. m. 49  39  15  Answer.
```

OR THUS.

```
  164 26
  30438
  ———————
  131413
  492800
  6570666
 492800009
 —————————
```

Answer 49 9 or 50 B. m.

BY RULE 2.

Mad m. B. m. B. m. v. pl pw.
As 1232 . 375 :. 164 2 5 3

```
 ———          ————————
3942400        525653
                  375
               ———————   B m s. ck..
   3942400)19711985/5( 49  39  15.9 Ans.
```

```
        164 26
           375
  —————————————
  1232)616000b
  —————————————
```

Answer Bazar mon 50

Reduce 505 Madras mons, to Calcutta bazar mons.
Answer Bazar mons 153 28 8.748

Reduce 95 Madras mons, to bazar mons. Answer Bazar mons 28 36 10.608

*NOTE.*—When the weight is given in Candies, reduce them to mons, and proceed as before.

## To change Madras garce, into bazar mons.

*RULE.*—As 10 garce : is to 1127 bazar mons :: so is the given weight to the answer. Or divide the given weight by .0088/3, and the quotient is the answer.

### *EXAMPLES.*

In 4 garce, 34 parah . 4.6 mar., how many bazar mons ?
Work by either of the following proportions:

BY GENERAL RULE.

| | | | | lb. oz. drs. |
|---|---|---|---|---|
| As 1 garce .......... | : 9256 lb. 8 oz. :: | 4 garce, 34 par, 4.6 mar. | : 41066 10 10.6 | |
| Then 82 lb. 2 oz. 2.13 | : 1 bazar mon . :: | 41066 lb. 10 oz. 10.6 drs. | : 500 Anf. | |
| Or 82.13 lb. ........ | : 9256.5 lb. ... :: | 4.4365 garce ............... | : 500 | |

BY ABOVE RULE.

As 10 garce ...... .. : 1127 baz. m. :: 4 garce, 34 par., 4.6 mar. : 500 Anf.
Or 10 ditto ......... : 1127 ditto :: 4.4365 garce ............... : 500
Or .008873 garce .. : 1 bazar mon :: 4.4365 ...................... : 500

.008873) 4.436500 (500 bazar mons. Anfwer.
44365
———
00

In 40 garce, how many bazar mons. Anfwer 4508 bazar mons.

In 1 garce, how many bags of rice, containing each 2 bazar mons? Anf. 56 bags & 28 fars.

TO REDUCE MADRAS MONS INTO FACTORY MONS.

*EXAMPLES.*

Reduce 149 Madras mons 2 vis . 26.6 pol., to factory mons.

BY GENERAL RULE.

As .. 1 Madras mon . . . : 25 lb. . . . . . . . :: 149 2 26.6 : 3733 5 5.3
Then 74 lb. 10 oz. 10.6 drs. : 1 fact. mon . . . :: 3733 5 5.3 : 50 Anf.
Or .. 74.6 lb. . . . . . . . : 1 do. . . . . . . . . . :: 3733 3 . . . : 50

OR THUS.

As .. 1 Madras mon . . . . : 13 fars. 6.3 ck. fact. wt. :: 149 2 26.6 : 50
Or .. 1 Madras mon . . . . : .33482 . . . . . . . . . :: 149.3 . . . : 50

OR THUS.

As .. 224 Madras mons . . : 75 fact. mons . . . . :: 149 2 26.6 : 50
Or .. 224 ditto . . . . . . . : 75 do. . . . . :: 149.3

```
              149.3
                75
              ————
              7466
             104533
             ——————
  224) 11200.0 (50 fact. mons. Anf.
       1120     —
       ————
          0
```

In

In 50 Madras mons, how many factory mons. Anſwer 16 F. m. 29 ſ. 10 c.

In 75 Madras mons, how many factory mons. Anſwer 25 F. m. 4 ſ. 7 c.

*NOTE*.—When the given weight is in Candies, reduce them to Madras mons, and work as before.

## To reduce Calcutta weights to China pecul.

### GENERAL RULE.

As 1 mon of the given weight : is to its weight in avoirdupois : : so is the given weight : : to its weight in avoirdupois. Then as 133 lb. 5 oz. 5 3 drs. : is to 1 pecul : : so is the given weight reduced to avoirdupois : to the anſwer.

### OR [illegible]

Multiply the given weight, if in [illegible] mons, by 56 and divide the product by 100; the quotient is the [illegible]

### OR THUS.

If the given weight, is in bazar mons, multiply it by .616 and the product is the anſwer.

*EXAMPLES.*

In [illegible] factory mons, how many China pecul.

| | |
|---|---|
| [illegible] | 50 |
| 56 | .56 |
| [illegible] | 28. Anſwer. |
| Anſwer 28 Pecul | |

In 50 bazar mons how many pecul.

.616
50
Pecul . . 30.8 Anſwer.

In [illegible] factory mons, 2 [illegible], how many pecul? Anſwer [illegible]

In [illegible] bazar mons, 2 [illegible], how many pecul? Anſwer [illegible]

## To [illegible] China pecul to Calcutta weights.

*RULE* 1.—Reduce the given weight to avoirdupois, and divide it by 1 mon of the required weight in avoirdupois.

2.—

2.—If the required weight is factory mons, multiply the given weight by 100, and divide the product by 56; or divide the given weight by .56, and the quotient is the answer.

3.—If the required weight is bazar mons, divide the given weight by .616, the quotient is the answer.

*EXAMPLES.*

In 28 pecul how many factory mons?

```
     28
    100
    ----
56) 2800 (50 factory mons. Ans.
    280
```

In 30 pecul, 8 catties, how many bazar mons?

```
.616) 30.80 (50 bazar mons. Ans.
      3080
      ----
         0
```

*NOTE.*—Reduce pecul to lbs. avoirdupois, by multiplying by 4, and dividing the product by 3.

Reduce avoirdupois weight to pecul, by multiplying by 3, and dividing the product by 400.

Reduce 1 pecul, to factory weight. Answer 1 m. 31 s. 6 c. $\frac{55}{40}$.

Reduce 1 pecul, to bazar weight. Answer 1 m. 35 s. 3 c.

## TARE AND TRETT.

ARE allowances made among merchants, in such goods as are sold by weight.

GROSS WEIGHT,—is the whole weight including package.

TARE, is the weight of the bag, box, &c. wherein the goods are packed.

TRETT, is an allowance for dust, waste, &c. made by the seller to the buyer.

SUTTLE,

SUTTLE, is when the tare, is deducted from the grofs weight.

CLOFF, is an allowance on every draught, on fome forts of goods.

NETT WEIGHT, is when all allowances are deducted from the grofs weight.

When the tare is at fo much in the grofs weight to find the Nett weight.

*RULE.*—Subtract the Tare from the grofs weight, and the remainder is the nett weight.

*EXAMPLES.*

What is the nett weight of 100 dubbers of Ghee, each weighing 2 bazar mons 5 fars, tare on the whole 6 baz. mons, 10 fars, 5 ck.

| | | | | |
|---|---|---|---|---|
| | 100 | | | |
| | 2 | | | |
| far | 200 | | | |
| 5 . . . $\frac{1}{8}$ | 12 | 20 | 0 | |
| | 212 | 20 | 0 | Grofs weight. |
| | 6 | 10 | 5 | Tare. |
| Bazar mons | 205 | 9 | 11 | Nett weight. |

What is the nett weight of 3 hogfheads of Sugar, weighing as follows.

| | | Baz. m. | s. | ck. | Tare s. | ck. |
|---|---|---|---|---|---|---|
| No. . . . | 1 | 4 | 15 | 2 | 10 | 3 |
| | 2 | 3 | 5 | 0 | 8 | 2 |
| | 3 | 2 | 30 | 4 | 7 | 0 |
| Grofs weight . . . . | | 10 | 10 | 6 | 25 | 5 |
| Tare . . . . . . | | 0 | 25 | 5 | | |
| Nett weight . . . . | | 9 | 25 | 1 | | |

What is the nett weight of 5000 bags of rice, weighing 2 mons 6 fars each, allowing 50 mons 6 f. for tare and trett. Anfwer 10699 m. 34 s.

When the tare is at fo much per box, bag, &c. to find the nett weight.

*RULE.*—Multiply the tare of each box, or bag, &c., by the number of boxes, &c., fubtract the product from the grofs as before, and the remainder will be the nett weight.

*EXAMPLES.*

What is the nett weight of 8 frails of raisins, each weighing 2 cwt. 3 qrs. gross; tare at 22 lb. per frail.

| | cwt. | qrs. | | | |
|---|---|---|---|---|---|
| | 2 | 3 | | | 22 |
| | | 8 | | | 8 |
| Gross . . | 22 | 0 | | | lb. 176 or 1 cwt. 2 qrs. 8 lb. |
| Tare . . | 1 | 2 | 8 | | |
| Nett . . | 20 | 1 | 20 | | |

What is the nett weight of 40 bales of silk, each weighing 4 fact. mons, 20 fars gross; tare at 9 fars per bale. Answer 171 mn. nett.

When the tare is at so much per cwt., mon, &c. to find the nett weight.

*RULE.*—Divide the whole gross weight, by said part or parts, that the tare is of the integer of the given weight, and the quotient will be the tare, which subtracted from the gross, as before, gives the nett weight.

*EXAMPLES.*

What is the nett weight of 22 boxes of sugar, each weighing 2 mons 15 fars gross, tare at 5 fars per mon.

| | | | | |
|---|---|---|---|---|
| | 22 | | | |
| | 2 | | | |
| far | 44 | | | |
| 10 . . $\frac{1}{4}$ | 5 | 20 | | |
| 5 . . $\frac{1}{2}$ | 2 | 30 | | |
| far | 52 | 10 | 0 | Gross. |
| 5 . . $\frac{1}{8}$ | 6 | 21 | 4 | Tare. |
| Mons | 45 | 28 | 12 | nett weight. |

What is the nett weight of 9 hogsheads of sugar, each weighing 6 cwt. 2 qrs. 12 lb. gross, tare 17 lb. per cwt. Answer 50 cwt. 1 qr. 21 lb.

## BARTER.

IS the changing of one commodity for another and informs us how to proportion the value of any goods, so that neither party may sustain any loss; and if the commodities exchanged are not of equal value the defect is supplied with money.

RULE.

*RULE* 1.—Find the value of that commodity whofe quantity is given, then find the quantity of the other at the given rate, you can have for the aforefaid value, which quantity will be the anfwer.

2.—When one has goods at a certain price ready money, but in bartering advances it to fomething more; fay, as the ready money price of the one: is to its bartering price :: fo is the ready money price of the other: to its bartering price; then the quantity of the latter commodity may be found either from the ready money or the bartering price.

### *EXAMPLES.*

How much Sugar at 8 fi. r. 8 an. per bazar mon, muft be given in barter for 4 chefts of Tea, at 180 ficca rupees per cheft?

```
180   then, As  8  8  0  :  1  ::  720
  4            16                   16
---            ---                 ---  ms.  fr.  ck.
720            136           136)11520( 84   28  3.7 Anf.
---                          ---------  ------------
                              rem. 96
                                   40
                                  ---
      OR THUS                 136)3840(28 fars.
8.5) 720.0(84.7058                 ----
            40                 rem  32
     --------------                 16
      fars 28.232                  ---
             16               136)512(3.7 ck.
       ---------                  408
       ck. 3.7 &c.                ---
           ---                    104
                                  ---
```

How many yards of cloth, at 9 ficca rupees per yard, muft I give for 1000 yards of muflin at 2 an. per yard? Anfwer 13 yards 3 qrs. $2\frac{2}{9}$ nails.

RULE 2.

A. and B. barter. A. hath 30 cwt. of prunes at 6d. per lb. ready money, but in barter will have $7\frac{1}{2}$ d. per lb.; B. hath fugar worth 36 fhillings per cwt. ready money; what ought B. to rate his fugar at, in barter, and what quantity muft be given for the 30 cwt. of prunes?

| cwt. | | a. a. sh. | sh. cwt. sh. |
|---|---|---|---|
| 30 | | then 6 : $7\frac{1}{2}$ :: 36 | again 45 : 1 . . : . . 2100 |
| 112 | | 7 | 1 |
| 3360 lb. | | d 252 | 45)2100 |
| $7\frac{1}{2}$ | | $\frac{1}{2}$ 18 | Answer Cwt. 46 2 18.6 lb. |
| 25200 pence, or 2100 sh. | | 6)270 | |
| | | Rate 45 sh. | |

A. hath tea at 8 s. 6 d. per lb. ready money, but in barter will have 10 s. per lb.; B. hath tobacco worth 18 d. per lb. ready money; how must B. rate his tobacco per lb. that his profit may be equivalent with A.'s. Answer 1 s. 9 $\frac{3}{17}$ d. per lb.

## LOSS AND GAIN.

IS the rule by which we discover the gain or loss, by any parcel of goods, and so instructs us, how to raise or fall the price of any commodity in such proportions, that neither our gain may be so exorbitant as to injure our customers, nor our loss so great as to impoverish ourselves, which is generally at so much per cent.

In this rule there are great varieties, all of which may be easily solved by the following proportions:

When the buying and selling prices are known; and the rate per cent. gain or loss required.

*RULE.*—As the whole quantity of the goods; is to the whole cost and proposed gain :: so is any part of said goods :: to the price they must be sold for.

When the proposed gain or loss is at so much per cent., make 100 with the gain or loss added to it, your second term.

*EXAMPLES.*

Bought 300 yards of cloth at 7 r. 8 an. per yard; and sold it again for 9 r. 4 an. per yard; what did I gain by the whole?

300

```
        300 at 7 r. 8 a.                 300 at 9 r. 4 an.
          7                                9
        ----                             ----
a.      2100                     a.      2700
8 .... ½ 150                     4 ... ¼   75
        ----                             ----
Cost .... R. 2250                Rs. 2775 sold for
        ----                         2250 cost.
                                     ----
                                 Rs. 525 gained. Ans.
                                     ----
```

Suppose I give £. 46 for 9 cwt. 2 qrs. 18 lb. of sugar, at what rate must I sell it per lb. to gain 12 £. 12 s. by the whole?

```
                              £    s.  d.
                              46   0   0 cost.
                              12  12   0 gain.
Cwt. qrs. lb.                 ----------                        lb.
As 9  2  18 . . . : . . . .   58  12   0 . . . :: . . . . .      1
   4                          20
   -                          --
   38                 1082)1172 (1 s. 0¾ 1074/1082 per lb. Answer.
   28                      ----
   --                 rem.   90
 1082                        12
                           ----
                           1080
                              4
                           ----
                      1082)4320(¾
                           ----
                      rem. 1074
                           ----
```

If I buy Tea at 8 r. 8 an. per lb. and sell it again for 10 r. 8 a. per lb.; what is the gain per cent.?

```
                     R. A.
                     10 8             100
                      8 8              16
R. A.                ----             ----
As 8 8 . . . . : . . . 2 0 . . . :: . . . 1600
   16                                    2
   --                                 ----                R.
  136                          136)3200( 23 40/136 or 23 5/17 per cent.
                                  ----
                             rem.   40
                                  ----
```

I purchased an invoice of Europe Goods amounting to £. 500 at 50 per cent. advance, allowing 2s. 3d. per current rupee; I sold the whole at the rate of 1 sicca rupee for

every

every shilling on the original amount £. 500; what did my gain amount to and how much per cent.? Answer Gain sr. 4252 14 0. and 74 per cent.

## MIXTURES.

WHEN the price and quantity of several commodities are given to be mixed, to find the mean price of that mixture; this is called ALLIGATION MEDIAL.

*RULE.*—As the whole composition : is to its total value :: so is any part thereof; to its mean price.

### *EXAMPLES.*

A wine merchant mixes 50 gallons of Madeira, at 4 rupees per gallon, with 30 gallons, at 3 rupees per gallon, 30 gallons at 2 rupees per gallon, 20 gallons of Teneriffe Wine, at 12 annas per gallon, and 10 gallons of Vin de Grave at 8 annas per gallon; how may he sell this mixture per gallon?

| Galls. | R. A. | R. |
|---|---|---|
| 50 at | 4 . . . | 200 |
| 30 . . | 3 . . . | 90 |
| 30 . . | 2 . . . | 60 |
| 20 . . | 0 12 . | 15 |
| 10 . . | 0 8 . | 5 |
| 140 | | 140)376 |

Rs. 2 10 3.4 Ans.

I purchased 63 gallons of Brandy at 4 rupees per gallon, 63 gallons at 3 r. 8 a. per gollon, 63 gallons, at 3 rupees per gallon; I want to reduce the price by mixing it with 40 gallons of Bengal Rum, at 12 annas per gallon, and wish to know what I can sell it for per gallon, to gain 25 per cent.?

Galls.

| Galls. | | R. | A. | | R. | A. |
|---|---|---|---|---|---|---|
| 63 | at | 4 | 0 | ........ | 252 | 0 |
| 63 | .. | 3 | 8 | ........ | 220 | 8 |
| 63 | .. | 3 | 0 | ........ | 189 | 0 |
| 40 | .. | 0 | 12 | ........ | 30 | 0 |
| 229 | | | | | 691 | 8 |

As 100 .. : 125 ... : : 691 8
125
864 6

| | Gall. | R. | A. | Gall. |
|---|---|---|---|---|
| Then, as | 229 ... | 864 | 6 ... | 1 |

15

229)13830

16)60 an. 4 p.

R. 3 12 4 Answer.

I have 5 pipes of Madeira Wine of different qualities and prices, but have no prospect of being able to sell the inferior qualities; thus, 1 pipe at 700 rupees, 1 pipe 500, 1 pipe 300, 1 pipe 200, and 1 pipe at 150 rupees; suppose I mix them together, what can I afford to sell them at per pipe? Answer 370 rupees per pipe.

When the rates of several commodities are given, to find such quantities of them, as being mixed together, shall bear a proposed price; this is called ALLIGATION ALTERNATE.

*R U L E.*—Write down the different, rates reduced to the same denomination, the highest uppermost, the next higher below that, and the rest in the same order; and set down the mean rate on the left hand of these.

Connect or link together, the several rates thus ranked, one with another in such a manner, that every one less than the mean, be linked with some one or more greater, or with as many as you please that are greater; and every greater with one less, or as many less as you please, than the given mean.

Take the difference between each of the rates and the mean rate, and write it down against that with which it is linked, and if only one difference stand against any rate, it will be the quantity belonging to that rate, but if there are several, then their sum will be the quantity, which quantities are the answer for that rate, against which they stand.

Add up all the differences, and their sum will be the sum of the mixtures, at the given or mean rate, and the several differences will as-

certain

certain the quantity of each ingredient to be taken in compounding the mixtures.

### *EXAMPLES.*

A Person hath brandy, which he values as follows; some at 5, some at 4, some at 3, and some at 2 rupees per gallon; but as the highest price was seldom called for, and the lowest complained of, he proposes to make a mixture out of the whole, which will stand him at 3 rupees per gallon; how many gallons of each must he take to answer his purpose?

| R. | GAL. | R. | R. | | OR THUS. |
|---|---|---|---|---|---|
| 5 —— | . . 1 at | 5 | . . . 5 | 5 —. | . . 0 at 5 . . 0 |
| | 0 | | 0 | | 4 |
| 3 | 1 | | 3 | | 6 |
| | 2 | | 4 | | 2 |
| | | | —— | | |
| | | | 12 | | |

I would mix a quantity of sugar at 10 rupees per mon, with other sugar, at 7 r. 8 an. 5 r. 8 an., and 4 r. 8 an. per mon, in such proportions as to make the mixture worth 6 rupees per maund; what quantity of each must I take? Answer $1\frac{1}{2}$ mon at 10, 1 mon at $7\frac{1}{2}$, $1\frac{1}{2}$ mon at 5, and 4 mons at $4\frac{1}{2}$ rupees per mon.

I wish to mix sugar at 10 d., 5 d., and 4 d. per pound, so that the composition may be worth 6 d. per pound, what quantity of each must I take? Answer 3 lb. at 10 d. 4 lb. at 5 d. and 4 lb. at 4 d.

*NOTE.*—Examples of this nature will admit of as many answers, as there are different ways of linking together, a larger price and a lesser, than the mean rate proposed; the compounder may therefore take choice of either, as may best suit his convenience.

When the price of each simple is given, also the quantity of one of them, and the mean rate and price; to find the several quantities of the rest in proportion; this is called Alligation Partial.

*RULE.*—Take the difference between each rate and the mean rate, as in the last rule.

Then, as, the difference belonging to that price whose quantity is given : is to the given quantity :: so is each of the other differences : to its respective quantity sought.

### *EXAMPLES.*

With 10 sars of tea at 10 rupees per sar, I would mix sorts at 4, 5 and 8 rupees per sar, in order to sell the mixture at 7 rupees per sar, what quantity must I take of each sort?

10

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10 ] | . . 3 | Then as 3 : 10 :: 3 : | 10 | at | 4 | . . | 40 |
| | 4 ] | . . 3 | 3 : 10 :: 1 : | $3\frac{1}{3}$ | at | 5 | . . | $16\frac{2}{3}$ |
| 7 | 5 ] | . . 1 | 3 : 10 :: 2 : | $6\frac{2}{3}$ | at | 8 | . . | $53\frac{1}{3}$ |
| | 8 ] | . . 2 | and | 10 | at | 10 | . . | 100 |
| | | | | 30 | at | 7 | . . | 210 |

How much tea at 6s. 6d.; 7s. 6d.; and 9s. per lb. must be taken to be mixed with 36lb. at 12s. per lb., that the mixture may be worth 8s. per lb.? Ans. 108lb. at 9s. 288lb. at 7s. 6d. and 72 lb. at 6s. 6d.

When the particular prices of each simple and the quantity of the whole mixture, also the mean price are given: to find the particular quantity of each sort in the mixture; this is called ALLIGATION TOTAL.

*RULE.*—Take the difference of each price, and the mean rate, as before.

Then, as the sum of all the differences: is to the whole quantity given :: so is each particular difference: to its particular quantity sought.

*EXAMPLES.*

I have by me four sorts of sugar, viz.; of 5, 6, 8, and 9 rupees per mon, and I am inclined to mix up a quantity of 168 mons, so as to make it worth 7 rupees the mon; in what proportion must the sugar be taken.

| | | | SUM. | MON. | DIFF. | MON. | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | . . . . 2 then, as | 6 : | 168 : : | 2 : | 56 | at 5 | 280 |
| | 6 | . . . . 1 | 6 : | 168 : : | 1 : | 28 | at 6 | 168 |
| 7 | 8 | . . . . 1 | 6 : | 168 : : | 1 : | 28 | at 8 | 224 |
| | 9 | . . . . 2 | 6 : | 168 : : | 2. | 56 | at 9 | 504 |
| | | Sum. 6 | | | | 168 | at 7 | 1176 |

How much gold of 16, of 18, and 23 carats fine, must be mixed together to form a composition of 60 oz. of 20 carats fine? Ans. 15 oz. of 16; 15 oz. of 18; and 30 of 23 carats fine.

*NOTE.*—An ounce divided into 24 equal parts are called carats, and when any composition or coin consists of 22 carats of gold and 2 of copper or alloy, it is said to be 22 carats fine, &c

## PARTNERSHIP.

WHEN two or more persons join together in business, they are said to be in *Partnership*, or *Company*, and the persons so engaged are called the *Firm*.

To determine each perſons particular ſhare of the gain or loſs, in proportion to the principal or ſhare, he may have in the firm or concern.

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## WITHOUT TIME.

*R U L E.*—As the ſum of the ſeveral ſtocks: is to the gain or loſs:: ſo is each perſons ſhare in the ſtock:: to his ſhare in the gain or loſs.

*P R O O F.*—Add all the ſhares together, and that ſum, if right, will be equal to the whole gain or loſs.

*E X A M P L E S.*

A. and B. join in partnerſhip; A. advances 8000 rupees, B. advances 6000 rupees, when they balanced their books, they found there was a clear profit of 5000 rupees, how much is each partner's ſhare.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8000 | then, as, | 14000 | : | 5000 | :: | 8000 | : | 2857 | 2 | $3\frac{3}{7}$ | A's ſhare. |
| 6000 | | | | | | | | | | | |
| 14000 | | 14000 | : | 5000 | :: | 6000 | : | 2142 | 13 | $8\frac{4}{7}$ | B's ſhare. |
| | | | | | | Proof | .. | 5000 | | | |

A. B. C. and D. were concerned in a ſhip, whereof A. had $\frac{1}{2}$, B. C. and D. $\frac{1}{6}$ each; when ſhe was ſold off and all accounts ſettled, there remained 55466 rupees, how much was each perſons dividend or ſhare? Anſ. A. ſhare 27733 B. C. and D. ſhare each 9244 5 4.

---

## WITH TIME.

Is when each perſons ſtock continues unequal time in company ſo that a conſideration may be made of the time, as well as of the ſtock.

*R U L E.*—Multiply each perſon's ſtock by the time, it has continued in the concern, and proceed with the products, as with the particular ſtocks without time.

*E X A M P L E S.*

Four merchants A. B. C. and D. enter into partnerſhip, thus:

A. put in 6000 rupees for 4 months.
B. .... 5000 ... for 6 months.
C. .... 4000 ... for 8 months.
D. .... 3000 ... for 12 months.

They

They gain 10,000, what is due to each proportionably to stock and time

| | | | |
|---|---|---|---|
| A's stock | 6000×4 | . . . . . | 24000 |
| B . . . . | 5000×6 | . . . . . | 30000 |
| C . . . . | 4000×8 | . . . . . | 32000 |
| D . . . . | 3000×12 | . . . . . | 36000 |
| | | sum . . . | 122000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Then, as | 122000 | : . . . | 10000 | :: | 24000 | : | 1967 | 3 | $4\frac{112}{122}$ | to A. |
| | 122000 | : | 10000 | :: | 30000 | : | 2459 | 0 | $3\frac{18}{122}$ | to B. |
| | 122000 | : | 10000 | :: | 32000 | : | 2622 | 15 | $2\frac{68}{122}$ | to C. |
| | 122000 | : | 10000 | :: | 36000 | : | 2950 | 13 | $1\frac{46}{122}$ | to D. |
| | | | | | Proof . . . | | 10000 | 0 | 0 | |

*NOTE.*—Questions of this kind seldom or never occur in business; all difference in point of time, in computations of partnership, are adjusted by an interest account, therefore farther examples would be useless.

## POSITION.

THE RULE OF POSITION, or trial and error, is so called because we suppose some uncertain number or numbers; and by reasoning from them according to the nature of the question, and paying proper attention to the error, or errors, obtain a true answer.

## SINGLE POSITION.

BY SINGLE POSITION, or a single supposition, are solved those questions, wherein the results are proportional to their suppositions.

*RULE.*—Suppose some convenient number, and proceed with it according to the nature of the question; then, if the result be either too much or too little; say, as the false number resulting: is to the true number given :: so is the given or supposed number; to the number required.

EXAMPLES

*EXAMPLES.*

A person being asked how many sheep he had got, replied, if you add $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$ of the number together, the sum will be 18. How many had he?

Suppose he had . . . . . . 12

Then $\frac{1}{3}$ of 12 . . is . . . 4
$\frac{1}{4}$ . ditto . . . . . . . 3
$\frac{1}{6}$ . ditto . . . . . . . 2

The sum is 9 but should be 12.
Hence, as 9 : . 18 . : : 12 : 24 sheep. Answer.

Proof.
24
$\frac{1}{3}$ . . . . 8
$\frac{1}{4}$ . . . . 6
$\frac{1}{6}$ . . . . 4
18

What sum is that, of which the half, third and fourth, make 520 £. Answer 480.

A. B. and C. buy a parcel of timber, which cost £. 48, and it is agreed, that B. should pay a third part more than A., and C.; and a fourth part more than B.; what sum must each pay? Answer A 12 £. B. 16 £. C. 20 £.

A Schoolmaster being asked how many scholars he had, answered, if I had as many, and one fourth as many, I should have 198; how many had he?
Answer 72 scholars.

## DOUBLE POSITION.

By Double Position, or two suppositions, are solved those questions wherein the results are disproportional to their suppositions.

*RULE.*—Suppose any two convenient numbers, and proceed with them according to the nature of the question, marking the errors, with + or —, according as they exceed or fall short of the truth.

THEN

Multiply the first supposition by the 2d error, and the second supposition by the first error, and divide the sum of the products, by the sum of the errors, if they are differently marked, or the difference of the products, by the difference of the errors if they are marked alike, and the quotient will be the number sought.

OR

Multiply the difference between the two supposed numbers, by the

less

leſs error, and divide the product by the ſum of the errors, if they are differently marked; or by the difference if they are marked alike; and the quotient will be a correction of the number belonging to the leſs error, and muſt be added to it, if that error be leſs than the truth, or ſubtracted, if it be greater.

*EXAMPLES.*

What number is that, which being multiplied by 3, the product increaſed by 4, and that ſum divided by 8, the quotient may be 32.?

| Suppoſe | 12 | Again, ſuppoſe | 108 | | | ITS ERROR. |
|---|---|---|---|---|---|---|
| | 3 | | 3 | 1ſt. ſuppoſition | 12 | — 27 |
| | 36 | | 324 | 2d. ditto | 108 | + 9 |
| | 4 | | 4 | | 27 its error | 12 |
| | 8)40 | | 8)328 | | 2916 | 108 |
| quotient . | 5 | quotient .... | 41 | | 108 | |
| ſhould be | 32 | ſhould be .... | 32 | 27+9=36) | 3024 | |
| Error — | 27 | Error ...... + | 9 | | 84 | Anſwer. |

A Gentleman finding ſeveral beggars at his door, gave them 3d. each, and had 5d. remaining; he would have given them 4d. each, but wanted 7d. to do it; how many beggars were there? Anſwer 12 beggars.

When firſt the marriage knot was tied
Betwixt my wife and me,
My age did her's as far exceed
As three times three, doth three;
But when ten years and half ten years,
We man and wife had been,
Her age came up as near to mine.
As eight is to 16.
What both our ages was, I pray
Now tell me, on the wedding day? Anſwer. His age when married 45 years;
Her age when married 15 years.

## ARITHMETICAL PROGRESSION.

WHEN a ſeries of numbers increaſes, or decreaſes, by an equal exceſs, or difference, thoſe numbers are ſaid to be in ARITHMETICAL PROGRESSION, ſuch

ſuch as, 2, 4. 6. 8. 10, &c. or, 15. 14. 13. 12, &c. and the numbers which form ſuch ſeries are called the terms of the progreſſion. The firſt and laſt terms are uſually called the *extremes*; and any two equally diſtant from them, *means*.

*NOTE.*—If three numbers are in arithmetical progreſſion, the ſum of the *extremes*, will be equal to double the *mean*;

When the number of terms are even, as 1, 3, 5, 7, 9, 11, the ſum of the *two extremes*, will be equal to the ſum of any *two means* that are equally diſtant from the extremes, viz. 1, 3, 5, 7, 9, 11.

$1+11=12. \quad 5+7=12. \quad 3+9=12$

When the numbers of terms are odd, as, 4, 10, 16, 22, 28, the double of the middle figure or term will be equal to the ſum of the extremes, or to any two means equally diſtant from the middle term; viz. 4, 10, 16, 22, 28.

$16+16. \quad 22+10=32.$

In this rule there are five things to be conſidered, viz.

1.—The firſt term, commonly the leaſt.

2.—The laſt term, commonly the greateſt.

3.—The number of terms.

4.—The common exceſs, or difference.

5.—The aggregate, or ſum of all the terms.

Any three of which being given, the other two may be eaſily found.

1.——-When the two extremes, and the number of terms are given, to find the ſum of all the ſeries or terms.

*RULE.*—Multiply the ſum of the two extremes, by half the number of terms; or multiply the ſum of the two extremes into the number of terms, and divide the product by 2; the quotient will be the ſum of all the ſeries, or terms.

*EXAMPLES.*

How many ſtrokes does the hammer of a clock ſtrike in 12 hours?

| | | | OR THUS | |
|---|---|---|---|---|
| 1+12=13 | the ſum of the extremes | | 1+12=13 | ſum of the extremes |
| 6 | half the number of terms | | 12 | the number of terms |
| Anſwer 78 | ſtrokes | | 2)156 | |
| | | | Anſwer 78 | |

Suppoſe

Suppoſe 100 ſtones were placed in a right line, a yard diſtant from one another, and the firſt ſtone was a yard from the baſket, I demand how many miles he muſt travel that gathers them ſingly into the baſket? Ans. 5 miles 1300 yards.

If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 3, the greateſt 100, and the number of terms 17, what is the ſum of the terms? Ans. 884?

2.—When the two extremes and number of terms are given, to find the common difference.

*R U L E.*—The difference between the two extremes, divided by the number of terms leſs 1, the quotient will be the common difference.

*E X A M P L E S.*

A perſon had 12 children that differed alike in their ages; the youngeſt was 5 years old, the eldeſt 27, what was the difference of their ages, and the age of each?

27—5=22 the difference of the extremes.

12—1=11 the number of terms leſs 1.

Then 22÷11=2 the common difference, which added to the age of the youngeſt, and ſo on to the reſt, will give their ſeveral ages, viz. 5+2=7 the age of the ſecond, and ſo on for the reſt.

If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 4, the greateſt 100, and the numbers of terms 17, what is the common difference between each term; Ans. 6, the common difference.

A debt is to be diſcharged at 10 different payments in arithmetical progreſſion; the firſt payment is to be 5 l. and the laſt 50 £; what is the whole debt, and what muſt each payment be? Ans. 275 £. the whole debt; the common difference 5, therefore each payment, thus, 5,10,15,20 &c. to 50.

3. When the two extremes and common difference are given to find the number of terms.

*R U L E.*—Divide the difference of the two extremes by the common exceſs; add 1 to the quotient, and the ſum will be the number of terms.

*E X A M P L E S.*

The leaſt term of a ſeries in arithmetical progreſſion is 4, the greateſt 100, and the common difference between each term is 6, what is the number of terms?

100—4=96÷6=16+1=17 the number of terms.

A man going a journey, travelled the firſt day 2 leagues and the laſt day 23; he increaſed his journey every day 3 leagues, how many days did he travel. Ans. 8 days.

A man being asked how many children he had, answered, my youngest child is 5 years old, and the eldest 27, and that he had increased one in his family every two years, how many children had he? Ans. 12 children.

4.—When the last term, the common difference, and the number of terms are given, to find the first term.

*RULE.*—Multiply the number of terms less 1, by the common difference; the product subtracted from the last term leaves the first.

*EXAMPLES.*

The greatest term in a series of numbers in arithmetical progression is 100, the number of terms 17, and the common difference between each term 6; what is the least term?

$17-1 \times 6=96$; then $100-96=4$ Answer.

A man in 6 days went from Calcutta to a certain place, every day's journey was greater than the preceding one by four miles, his last day's journey was 40 miles; what was his first. Answer 20 miles.

5.—When the number of terms, common difference, and sum of all the terms are given, to find the first term.

*RULE.*—Divide the sum of the terms, by the number of terms; and from that quotient subtract half the product of the common difference or excess, by the number of terms less 1, the remainder will be the first term.

*EXAMPLES.*

The number of terms is 17, the common difference 6, and the sum of the terms, of a series of numbers in arithmetical progression is 884; what is the least term?

$884 \div 17=52$ and $17-1 \times 6=96$, then $52-\frac{96}{2}=4$ the least term.

If the number of terms be 22, the common difference 5, and the sum of the terms 1221; what is the least term? Answer 3.

6.—When the first term, number of terms, and the common difference are given, to find the last term.

*RULE.*—Subtract the common difference from the product of the number of terms, multiplied by the common difference, the remainder added to the first term, will give the last.

*EXAMPLES.*

What is the last term of an arithmetical progression, beginning at 6, and continuing by the increase of 3 to 21 places?

First $21 \times 3=63$, and $63-3=60$; then $60+6=66$ the last term.

If,

If the leaſt term of a ſervice of numbers in arithmetical progreſſion be 4, the number of terms 17, and the common difference 6, what is the greateſt term? Anſwer 100.

7.—The firſt term, common difference, and number of terms given, to find the ſum of all the terms.

*RULE.*—From the product of the number of terms in the common difference, ſubtract the common difference, and to the remainder add, the double of the firſt term; half the product of that ſum multiplied by the number of terms, gives the ſum of all the terms or ſeries.

*EXAMPLES.*

Suppoſe I agree to ſink a well 30 yards deep upon theſe terms, viz. to pay 3 ſhillings for the firſt yard, 5 for the ſecond, 7 for the third, &c. raiſing two ſhillings per yard, what will the whole amount to?

First $30\times 2=60$; alſo $60-2=58$

Again $58+6=64$, and $64\times 30=1920$

Then $1920\div 2=960$ s.$=$£ 48 the Anſwer.

8.—The firſt term, the number of terms, and ſum of all the terms given, to find the common difference.

*RULE.*—Divide the double ſum of all the ſeries, by the number of terms, and from the quotient ſubtract double the firſt term; divide the remainder, by the number of terms leſſened by unity, and the quotient wil be the common difference.

*EXAMPLE.*

A perſon travelled from Calcutta to Berhampore, being 180 miles in 6 days, and every day travelled equally further than the preceding day; it is known that the firſt day he travelled 6 miles; how many miles did he travel each of the other days?

Firſt $360\div 6=60$, and $60-12=48$, alſo $6-1=5$.

Then $48\div 5=9\frac{3}{5}$ miles, the common difference required.

And $9\frac{3}{5}$ added to 6 and every other term reſpectively gives, as follows, viz.

6 for

| | | |
|---|---|---|
| 6 for the firſt | | Days Journey. |
| $15\frac{3}{5}$ | ..... ſecond | |
| $25\frac{1}{5}$ | ..... third | |
| $34\frac{4}{5}$ | ..... fourth | |
| $44\frac{2}{5}$ | ..... fifth | |
| 54 | ..... ſixth | |
| Proof 180 | | |

## GEOMETRICAL PROGRESSION.

IS, when any rank or ſeries of numbers increaſe by one common multiplier, or decreaſe by one common diviſor.

As 4, 8, 16, 32, 64, 128, here the common multiplier or ratio is 2.
Alſo 729, 243, 81, 27, 9, 3, here the common diviſor or ratio is 3.

In any ſeries of numbers in geometrical progreſſion, the product of the two extremes are equal to the product of any two means, that are equally diſtant from the extremes.

As 3, 9, 27, 81, 243, 729
Here $3 \times 279 = 9 \times 243 = 27 \times 81 = 2187$

When the number of terms are odd, the middle term, multiplied into itſelf will be equal to the product of the two extremes, or any two means equally diſtant from the ſaid mean or middle term.

As 3, 6, 12, 24, 48. $12 \times 12 = 6 \times 24 = 48 \times 3 = 144$

In geometrical progreſſion, five things are to be obſerved, as in arithmetical progreſſion, viz.

1.—The firſt term. 2.—The laſt term. 3.—The number of terms. 4.—The ratio. 5.—The ſum of the terms.

Any three of theſe being given, the reſt may be eaſily found.

If over any rank of geometrical numbers, you place a ſeries of arithmetical ones beginning with 0, the addition and ſubtraction of the indices

answer

answer to the multiplication and division of the numbers they stand over.

thus { 0, 1, 2, 3, 4, 5, 6, 7 Indies.
1, 2, 4, 8, 16, 32, 64, 128 numbers in geometrical progression.

that is { As 2+3=5 which is the indice of 32.
So 4×8=32 the 5th term in geometrical progression.

again { As 2+4=6.
So 4×16=64. the 6th term.

Now by these indices and a few of the first terms, the last term, or any distant one, may be speedily found, without producing the whole series.

1.—When the first term is unity, the ratio and number of terms being known to find the last of any remote term.

*R U L E.*—Find a few of the leading terms, over which place their indices, as before directed; then find what figures of the indices, when added together will give the index of the term wanted, multiply the numbers standing under such indices into each other, the last product will be the term required.

*N O T E.*—When the indices begin with a cipher, the sum of the indices, made choice of must be always one less, than the number of terms given, in the question, because 1 in the indices, stands over the second term.

*E X A M P L E S.*

The first or least term of a series of numbers in geometrical progression is 3, the ratio 3, and the number of terms 14, what is the greatest or last term?

1, 2, 3, 4, 5, &c. indices.

3, 9, 27, 81, 243, &c. leading terms.

5+5+4=14 index to the 14th term.

243×243×81=4782969, last or 14th. term.

A boy agrees for 14 oranges, to pay only the price of the last, reckoning a farthing for the first, half penny for the second, &c. doubling the price to the last; how much did he give for them;

First { 0, 1, 2, 3, 4, 5, 6, indices.
1, 2, 4, 8, 16, 32, 64, terms.

then { 2+5=7.
4×32=128.

also { 7+6=13.
128×64=8192 which is the 14th. term, because the indices are less than the terms by 1, and 8192 qrs.=8 £. 10 s. 8 Answer.

If the first term be 2, the ratio 2, and the numbers of terms 19, what is the last or greatest term? Ans. 524288.

A man bought a horse, and by agreement was to give, what the last nail would come to, at a farthing for the first nail, two for the second, four for the third, &c. There were four shoes, and 8 nails in each shoe; I demand the price of the horse? Ans. 2236962 £. 2 s. 8 d.

2.—In any series not proceeding from unity, the ratio and first term being given, to find any remote term, without producing all the intermediate terms.

*RULE*.—Proceed as in the last case, only observe to divide every product by the first term, and the quotient will be the term required.

*EXAMPLE.*

A person dying left 11 children, to whom, and to his executor, he bequeathed in manner following, viz. to his executor for seeing his will performed £, 10, the youngest child to have £, 30. and so on every child to exceed the next younger in triple proportion, what will be the share of the eldest?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | Indices. |
|---|---|---|---|---|---|---|---|
| 10 | 30 | 90 | 270 | 810 | 2430 | 7290 | Terms. |

4+6=10 number terms less one.

Then 810×7290=5904900 which÷10 the first term gives £. 590490 the eldest child's fortune.

3.—When the first term, ratio and number of terms are given, to find the sum of all the terms.

*RULE*.—Find the last term as before, from which take the first, divide the remainder by the ratio, less one, and to that quotient add the last term and you have the sum required.

*EXAMPLES.*

A gentleman married and received of his Father in Law one guinea, on condition that he was to have a present, every month for the first year, which should be double still to what he had the month before; what was the young lady's portion?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | Indices. |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 4 | 8 | 16 | 32 | 64 | Terms. |

6×5=11 number of terms less one.

64×32=2048 the last term.

2048—1÷2—1=2047.

2048—2048=4095 Guineas, or 4299 £. 15 s. Answer.

VARIATIONS.

## VARIATIONS.

BY Variations, are meant the different ways any number of things may be altered or changed, with respect to their places. These are sometimes called CHANCES, PERMUTATION, ALTERNATION, &c.

To find the number of changes that can be made of any given number of things, all different from each other.

*RULE.*—Multiply continually together the numbers 1, 2, 3, 4, 5, &c. to the number of terms and the last product will be the answer.

*EXAMPLES.*

How many changes may be rung by 8 bells.

$1\times2\times3\times4\times5\times6\times7\times8=40320$ Answer.

How many changes may be rung on 9 bells? Answer 362880.

How many days can 7 persons be placed in a different position at dinner? Answer 5040 days.

An accomptant told a gentleman, who had constantly 8 persons at his table, that he would gladly make a ninth and was willing to give 20 guineas for his board, so long as he could place the said company at dinner, differently from any one day before; this being accepted what did his entertainment cost him per year. Answer $5\frac{5}{12}$ d.

## INVOLUTION
OR
## *THE RAISING OF POWERS.*

A POWER is the product arising from multiplying any given number into itself continually a certain number of times, thus,

$2\times2=4$ is the 2d power, or square of 2.

$2\times2\times2=8$ is the 3d power, or the cube 2.

$2\times2\times2\times2=16$ is the 4th power of 2;

The number denoting the power is called the index, or the exponent of that power.

If two or more powers are multiplied together, their product is that power whose index is the sum of the exponents of the factors: thus,

$2\times2=4$ the square of 2; $4\times4=16=4$th power of 2; and $16\times16=256=8$th power of 2, &c.

TABLE

## TABLE OF THE FIRST NINE POWERS OF NUMBERS.

| 1st. | 2d. | 3d. | 4th. | 5th. | 6th | 7th. | 8th. | 9th. |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512 |
| 3 | 9 | 27 | 81 | 243 | 729 | 2187 | 6561 | 19683 |
| 4 | 16 | 64 | 256 | 1024 | 4096 | 16384 | 65536 | 262144 |
| 5 | 25 | 125 | 625 | 3125 | 15625 | 78125 | 390625 | 1953125 |
| 6 | 36 | 216 | 1296 | 7776 | 46656 | 279936 | 1679616 | 10077696 |
| 7 | 49 | 343 | 2401 | 16807 | 117649 | 823543 | 5764801 | 40353607 |
| 8. | 64. | 512 | 4096 | 32768 | 262144 | 2097152 | 16777216 | 134217728 |
| 9. | 81. | 729. | 6561. | 59049. | 531441. | 4782969. | 43046721. | 387420489. |

*E X A M P L E S.*

What is 5th. power of 7 ?

7
7
---
49=2d. power
7
---
343=3d. power
7
---
2401=4th. power
7
---
16807=5th. power.
---

What is the 3d. power of 35 ? Anfwer 42875.

What is the 4th. power of $\frac{3}{4}$ ? Anfwer $\frac{81}{256}$.

What is the 5th. power of .029 ? Anfwer .000000020511149.

EVOLUTION

# EVOLUTION

OR

# THE EXTRACTION OF ROOTS.

THE root of any number, or power, is ſuch a number, as being multiplied into itſelf a certain number of times, will produce that power. Thus 2 is the ſquare root of 4, becauſe $2\times2=4$; and 4 is the cube root of 64 becauſe $4\times4\times4=64$; and ſo on.

Any power of a given number may be found exactly, but there are many numbers of which a given root can never be preciſely determined although by the help of decimals, we can approximate towards it, to any aſſigned degree of exactneſs.

The roots which approximate are called SURD ROOTS, and thoſe which are perfectly accurate are called RATIONAL ROOTS: thus the ſquare root of 2 is a ſurd root; and the cube root of 27 is a rational root, being exactly equal to 3.

Roots are ſometimes denoted by writing the character √ before the power, with the index of the root againſt it: thus the third root of 70 is expreſſed $\sqrt[3]{70}$, and the ſecond root of it is $\sqrt{70}$, the index 2 being always omitted, when the ſquare root is deſigned.

If the power be expreſſed by ſeveral numbers with the ſign + or — between them a line is drawn from the top of the ſign over all the parts of it; thus, the third root of $28-13$ is $\sqrt[3]{\overline{28-13}}$.

But all the roots are now generally deſigned like powers with fractional indices: thus, the ſquare root of 5 is denoted by $5^{\frac{1}{2}}$ the cube root of 19 by $19^{\frac{1}{3}}$ and the fourth root of $40-12$ by $\overline{40-12}^{\frac{1}{4}}$ &c.



## TO EXTRACT THE SQUARE ROOT.

THE extraction of the ſquare root is by having a number given, to find out another number, which being multiplied by itſelf, produces that given number.

RULE.

*R U L E.* 1.—Divide the given number into periods of two figures each by putting a point over the place of units, another over the place of hundreds, and ſo on.

2.—Find the greateſt ſquare in the firſt period, and ſet its root on the right hand of the given number, after the manner of a quotient figure in diviſion.

3.—Subtract the ſquare thus found, from the ſaid period, and to the remainder annex the following period for a dividend.

4.—Double the root abovementioned for a diviſor; and find how often it is contained in the dividend, excluſive of the place of units; and ſet the reſult both in the quotient and the diviſor.

5.—Subtract the product of this quotient figure and the diviſor, thus augmented, from the dividend, and to the remainder bring down the next period, for a new dividend.

6.—Find a diviſor as before, by doubling the figures already in the root; and from theſe find the next figure of the root, as in the laſt article; and ſo through all the periods to the laſt.

*N O T E.*—If there be decimals in the given number, it muſt be pointed both ways from unity, and the root be made to conſiſt of as many whole numbers and decimals, as there are periods belonging to each, and when the figures belonging to the given number are exhauſted, the operation may be continued at pleaſure by adding cyphers.

It may be alſo obſerved, that the beſt way of doubling the root, is by adding the laſt figure of it to the laſt diviſor.

*P R O O F.*—Square the root found, and to that product, add the remainder, if any; and that ſum will be the ſame as the number given to be extracted.

| Squares | 1. | 4. | 9. | 16. | 25. | 36. | 49. | 64. | 81. |
|---|---|---|---|---|---|---|---|---|---|
| Roots | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. |

Hence we may obſerve that if any number end with 2, 3, 7 or 8 the ſquare root of that number can never exactly found.

*E X A M P L E S.*

Required the ſquare root of 393129?

```
      393129(627 Root
      36
      --
  122)331
      244
      ---
 1247)8729
      8729
      ----
```

What

What is the square root of 436.5?

```
436.50000000(20 89:5, &c. Root.
4
-
408) 3650
     3264
     ----
4169 )38600
      37521
      -----
41782 )107900
        83564
       ------
417845 )2433600
         2089225
        --------
Remains  344375
```

*NOTE.*—In a mixed number make the number of decimal places even, by annexing ciphers to the right hand of the given square, that a point may fall on the units place of the whole number.

What is the square root of 2?

```
        2.000000000000(1.414213 Root.
        1
        -
     24)100
         96
        ---
    281)400
        281
        ---
   2824)11900
        11296
        -----
  28282)60400
         56564
         -----
 282841)383600
         282841
         ------
2828423)10075900
         8485269
        --------
Remains  1590631
```

What is the square root of 814602573? Ans. 28541.24, &c.

## To extract the square root of Vulgar Fractions.

*RULE.*—Reduce the fraction or fractional parts to their lowest terms, and if it be a mixed number, to an improper fraction; then

[illegible] root of the numerator and for a new numerator, and the square [illegible] the denominator for a new denominator. But if the fraction be [illegible] complete power, then reduce it to a decimal, and proceed as before.

*EXAMPLES.*

What is the square root of $\frac{288}{648}$?

First $\frac{288}{648}$ in its lowest terms is $=\frac{4}{9}$; the $\sqrt{\frac{4}{9}}=\frac{2}{3}$ the root required.

What is the square root of $\frac{2704}{4225}$? Answer $\frac{4}{5}$.

What is the square root of $6\frac{2}{5}$. Answer 2.5298, &c.

---

## TO EXTRACT THE CUBE ROOT.

TO extract the cube root, is to find out a number, which being multiplied into itself, and then again into the product, produceth the given number.

Cube. 1. 8. 27. 64. 125. 216. 343. 512. 729

Roots. 1. 2. 3. 4. 5. 6. 7. 8. 9

To extract the cube root of any whole number, or a pure or mixed decimal.

*RULE* 1.—Put a point over the units place, and also upon every third figure, from the right hand to the left, in whole numbers, and from the left hand to the right in decimals.

2.—Find the nearest less cube to the left hand period and subtract it therefrom: put the root in the quotient and bring down the figures in the next period for a RESOLVEND.

3.—Find a divisor by multiplying the square of the quotient by 300, [illegible] how often it is contained in the RESOLVEND, and put the answer in [illegible] quotient.

[illegible] Cube the last figure in the quotient, multiply all the figures in the [illegible] by 30, except the last and that product by the square of the [illegible] multiply the divisor by the last figure, and the sum of these

products

products will give the subtrahend, which take from the resolvend, to the remainder bring down the next period, and repeat the work.

*PROOF.*—Cube the root found, and to the product add the remainder, if any, and that sum will be the same as the number given to be extracted.

### EXAMPLES.

Extract the cube root of 48627.125

```
                 48627.125(36.5 Root
     3 cubed=27
             --
3 square X 300=2700)21627 resolvend
                    -----
             6 cubed=====216
     ------
        X 30 X 6 squared=3240
Divisor 27.. X last figure 6=16200
                       -----
                       19656 subtrahend
                       -----
  36 squared X 300=388800)1971125 resolvend
                          -------
                  5 cubed    =125
         36 X 30 X 5 squared=27000
Divisor 388800 X last figure 5 — 1944000
                          -------
                          1971125 subtrahend
                          -------
```

Required the cube root of 122615327232. Ans. 4968.

## To extract the cube root of any vulgar fraction.

*RULE.* 1.—Reduce the given fraction to its lowest terms, then extract the cube root of numerator, for a new numerator, and the cube root of the denominator, for a new denominator.

2.—If the fraction will not extract even, reduce it to a decimal, and then extract the cube root.

When the number to be extracted is a mixed fraction, reduce the fraction part to a decimal, and annex it to the whole number, then extract the cube root.

## *EXAMPLES.*

Extract the cube root of $\frac{243}{576}$?

First $\frac{243}{576} = \frac{27}{64}$; the cube root of 27 is 3, and that of 64 is 4; therefore the cube root of $\frac{27}{64}$ is $\frac{3}{4}$

Extract the cube root of $\frac{2}{3}$?

$\frac{2}{3} = .66666$, &c. the cube root of which is .87358, &c.

What is the cube root of $\frac{175}{470}$? Anf. .71638.

